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Operation and Application of the Ball Bearing

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Its qualifications in comparison with those of the plain bearing—Description of the action between balls and races —The material factor—Examples of successful application

THE ball bearing has qualifications which justify its use in many types of machinery. A given size will sustain a considerable variation of speed or load. The loads may be pure radial or thrust, or may be a combination of the two. There are self-contained qualities to accommodate misalignment from machining inaccuracies or deflection of surrounding parts without undue detriment to the bearing.

Because of simplification of the lubrication problem the maintenance cost is reduced to a minimum. The frictional loss is practically constant, which means that the operating temperature is held within slight variations over the bearing's whole range of speed and load. The initial cost is as low as that of a well-fitted plain bearing and the ultimate cost lower if upkeep is considered. In a plain bearing, the greater the load, the larger is the required projected area and consequently, the greater is the product of diameter and length. Otherwise, the unit pressure would tend to break down the supporting oil film and result in the bearing seizing.

The amount of surface in contact between balls and races, must also increase with the load and is of greater magnitude than is generally supposed. Actually, the ball bearing sustains the load by the ability of the steel, used in its manufacture, to compress and then to regain its original shape. In other words, the success of the ball bearing depends upon the grade of steel used. This ability is obtained by the use of steel which has an elastic limit nearly equal to its ultimate breaking strength.

As the load is sustained by contact area, it is obvious that the minimum load resisting ability will occur when the races are cylindrical as shown in Fig. 1 at *A*. This will cause maximum deflection of the balls and races and result in the greatest concentrated stress. The largest load can be carried by a bearing using grooved races whose radius exactly conforms to that of the ball as shown in Fig. 1 at *B*, but unfortunately, the relation of conformity and capacity is limited due to the difference in velocity of the parts in contact.

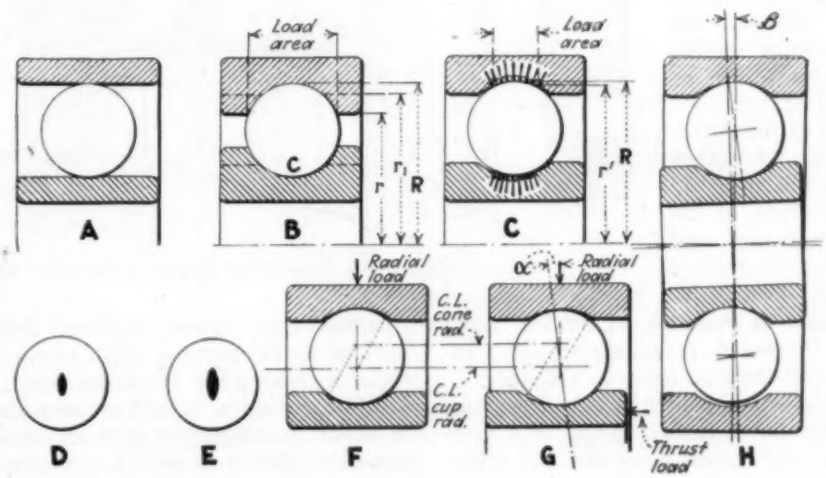


Fig. 1—Factors of design affecting operation

The cup or outer race at *B* may be considered as the revolving member. All points of the arc of contact of the ball on the cup race are moving with varying tangential velocities, increasing with their distance from bearing axis to a maximum at radius *R*. However, all points of the arc of contact of the cup on the ball are revolving about the contact of the ball on the cone, as an instantaneous center *C*, with velocities which likewise increase with

their distance from this nearer center. There exists a difference between the velocities at corresponding points at the common arc of contact. This so-called "slip velocity" increases with increasing race depth, reaching a maximum at the axis of ball rotation. To minimize this slip velocity, which will cause excessive friction, the ball race radius is made larger than the ball radius. The resulting arc of contact is made smaller and the necessary race depth is reduced to a value r_1 as shown.

Referring to Fig. 1 at *C* deformation occurs under load and the radii of both the race and the ball become larger. The difference between R and r_1, the maximum and minimum radii respectively, is reduced and the differential or slip velocity is correspondingly lessened. Under no condition, however, is the race radius proportioned to the ball so that deformation will allow the load contact area to extend out to the edges of the race.

For this reason, there is always an adequate amount of race section under slight stress which serves to buttress the more highly stressed section directly in contact with the ball.

An illustration of the size of the load area can be obtained by referring to Fig. 1 at *D* and *E*, which shows the actual contact on the ball on the cup. At *D* is shown the area under maximum normal load and at *E* under twice this load. Investigation has shown that, properly designed and installed, failure of a ball bearing does not occur because of wear between balls and race, that is to say, there is no measurable reduction in the diameter of the revolving parts. When failure does occur at this point, it is from fatigue of the surface due to continual flexure under load. The relation between the deformation and its frequency of occurrence determines the life of the bearing, it being possible from investigation of test records to determine, mathematically the approximate life for any condition of speed or load.

It is obvious if one of the conditions is increased while the other is held constant, the ultimate life will be reduced. Therefore, as the relation between frequency and amount of deformation determines the bearing life, if the load is increased, the speed must be reduced. Likewise, when the rotative speed is increased, frequency of deformation is also increased and the load must be reduced.

One of the most interesting points in a ball bearing is its ability to sustain either radial, thrust or a combination radial-thrust load within itself and yet maintain its original efficiency.

Under pure radial conditions the load will be carried directly through the center of the ball. The load line will be at right angles to the axis of the bearing and will intersect the center of the balls and the race radii as shown in Fig. 1 at *F*. However, as shown in Fig. 1 at *G*, directly that an end thrust is applied one of the race members will move until the lines intersecting the race radii and ball centers form an angle with the plane of the latter. This angle will increase with the magnitude of the thrust.

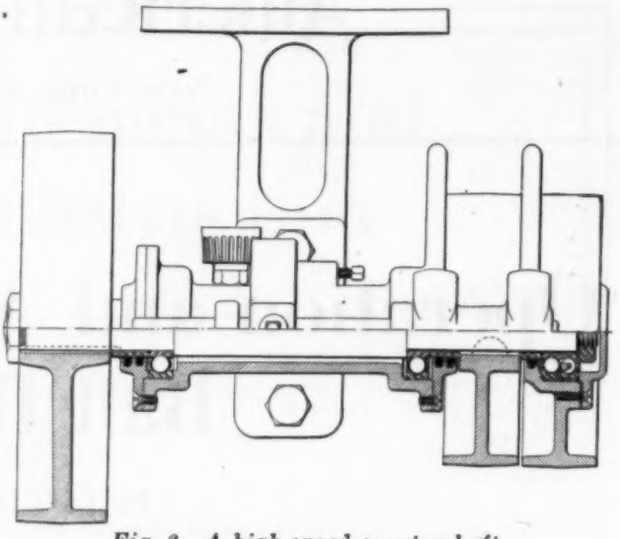


Fig. 3—A high-speed countershaft

The load on each ball may be resolved partly into a component which resists its share of the total thrust. It must be noted that the balls allow the races to readjust themselves to the load condition without wedging or cramping action occurring.

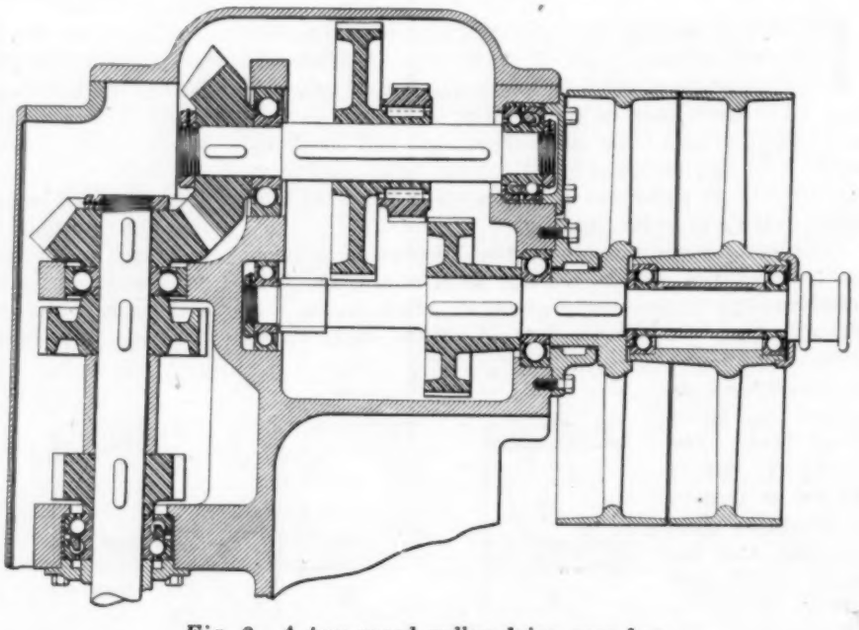


Fig. 2—A two-speed pulley-drive gear box

In most types of bearings shaft deflection or misalignment of parts causes a slight cramping action to occur which increases the frictional loss. The ball bearing, within certain limits, will accommodate shaft deflection or slight misalignment without cramping. To understand this ability, it must be remembered that the balls in the half of the bearing opposite the direction of the applied load are unloaded and due to deformation of the loaded parts of the bearing are actually free of the raceways.

Referring to Fig. 1 at *H*, which shows an exaggerated cross-section of an annular bearing under this condition, it will be seen that it is possible to pivot the inner race of the bearing around the maximum loaded ball until the unloaded balls come in contact with the sides of the races. Tests have shown that a bearing will operate in this condition within certain limits

without detrimental effect and that allowable misalignment, as indicated by angle *B*, is sufficient to take care of ordinary machining inaccuracies or material deflection.

The lubrication requirement of a ball bearing is simple. Actually, the surface pressure between the contact areas is so high that no oil film can be present and the bearing operates on metal-to-metal contact. This condition could not exist if nearly true rolling motion were not present. There is, however, a slight friction between the balls and retainer, or cage, whose function it is to keep the balls from rubbing against each other, and the principal function of the lubricant is to reduce this sliding friction. Other functions of the lubricant are first, to protect the highly finished surfaces against corrosion and, second, to improve the efficiency of the seal between the shaft and housing on which the bearing is mounted.

As the frictional loss is low and practically constant at all speeds and loads, the operating temperature of the bearing does not increase and there is less tendency for the lubricant to break down as the operating temperature is low. Therefore, no elaborate provision has to be made for lubrication and it is possible, with a correctly designed closure and proper lubricant, for it to run for a period of months without attention.

minimum. Maintenance cost is lowered as a result of the infrequent lubricating periods. Depreciation is lessened in the machine when its original accuracy is maintained as the ball bearing is capable of doing.

Low production costs are largely obtained by the use of higher manufacturing speeds. The use of individual motor drive on all types of machines necessitates considerable reduction in speed between the drive and the work spindle and has led, in many cases, to the adoption of the automobile type of speed-change box.

There is no position in which ball bearings can be applied to better advantage than at this point.

That ball bearings can simplify machine design is illustrated in Fig. 2, showing a two-speed gear box where it is necessary to receive power from an overhead shaft and deliver it to parts rotating in a horizontal plane. The first point of interest is in connection with the loose pulley. Ball bearings are installed and the hub arranged to be packed with grease every six months. The original fit-up of the bearings can then be retained indefinitely.

The main shaft is carried on annular bearings, the one nearest the pulley being clamped on inner and outer races, to locate the shaft and resist the slight end thrust which is set up when changing gears.

The sliding-gear shaft and the power take-off shaft

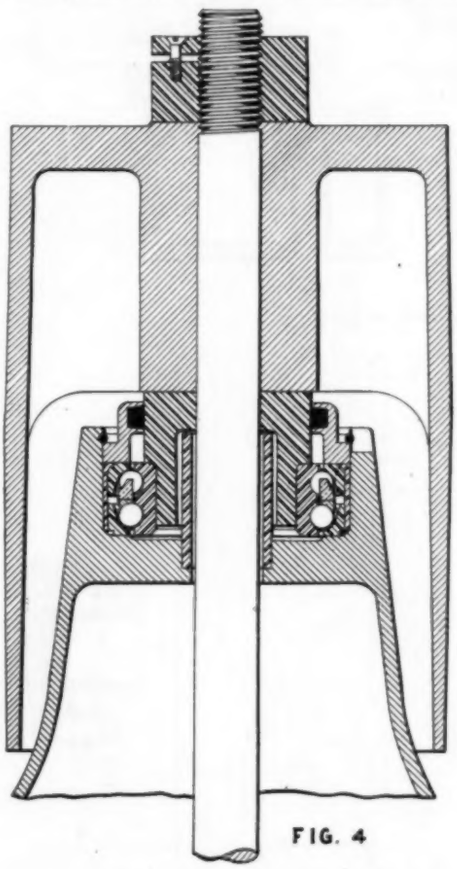


FIG. 4

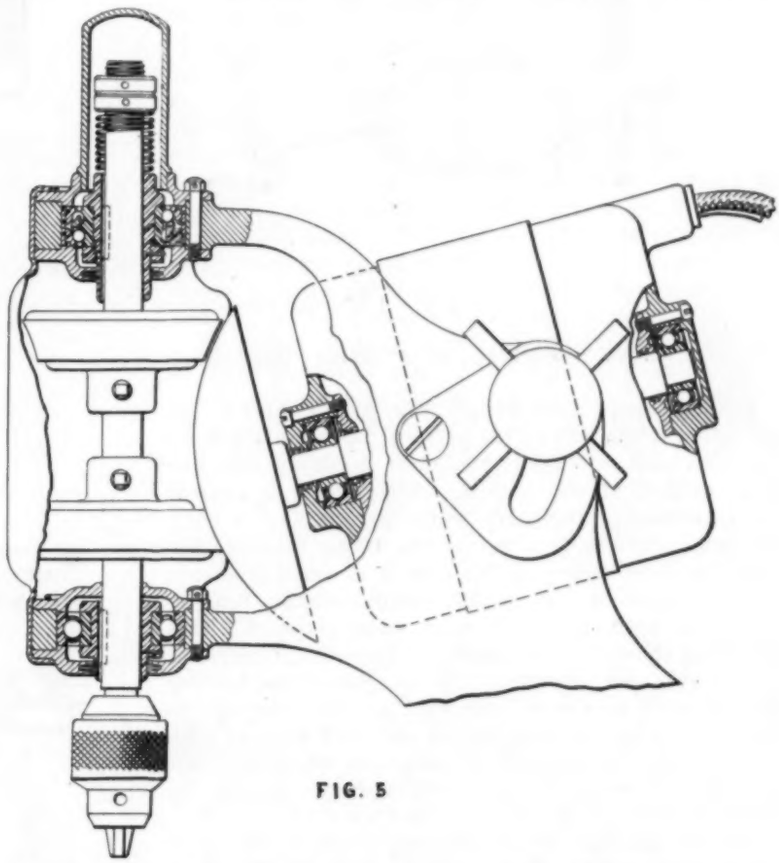


FIG. 5

Fig. 4—Mounting and lubricating a vertical drive. Fig. 5—A tapping spindle and its driving motor on ball bearings

Comparing a ball bearing with a well-fitted plain bearing, such as must be used in accurate machinery, it will be found that the initial cost of the ball bearing compares favorably, while the assembling cost may even be less. The upkeep or operating expense, due to replacement of parts because of wear is reduced to a

bearings have to resist the radial load, and also the thrust load imposed by the bevel gears. For this reason, a double angular-contact bearing, which has the important function of being able to carry radial load in combination with thrust from either direction, is used to support one end of the shaft. This bearing, of

course, is securely locked on both the inner and outer races to eliminate any end looseness.

Annular ball bearings are used back of the bevel gears, mounted so that the outer races float, thus allowing simple machining at a rather inaccessible point.

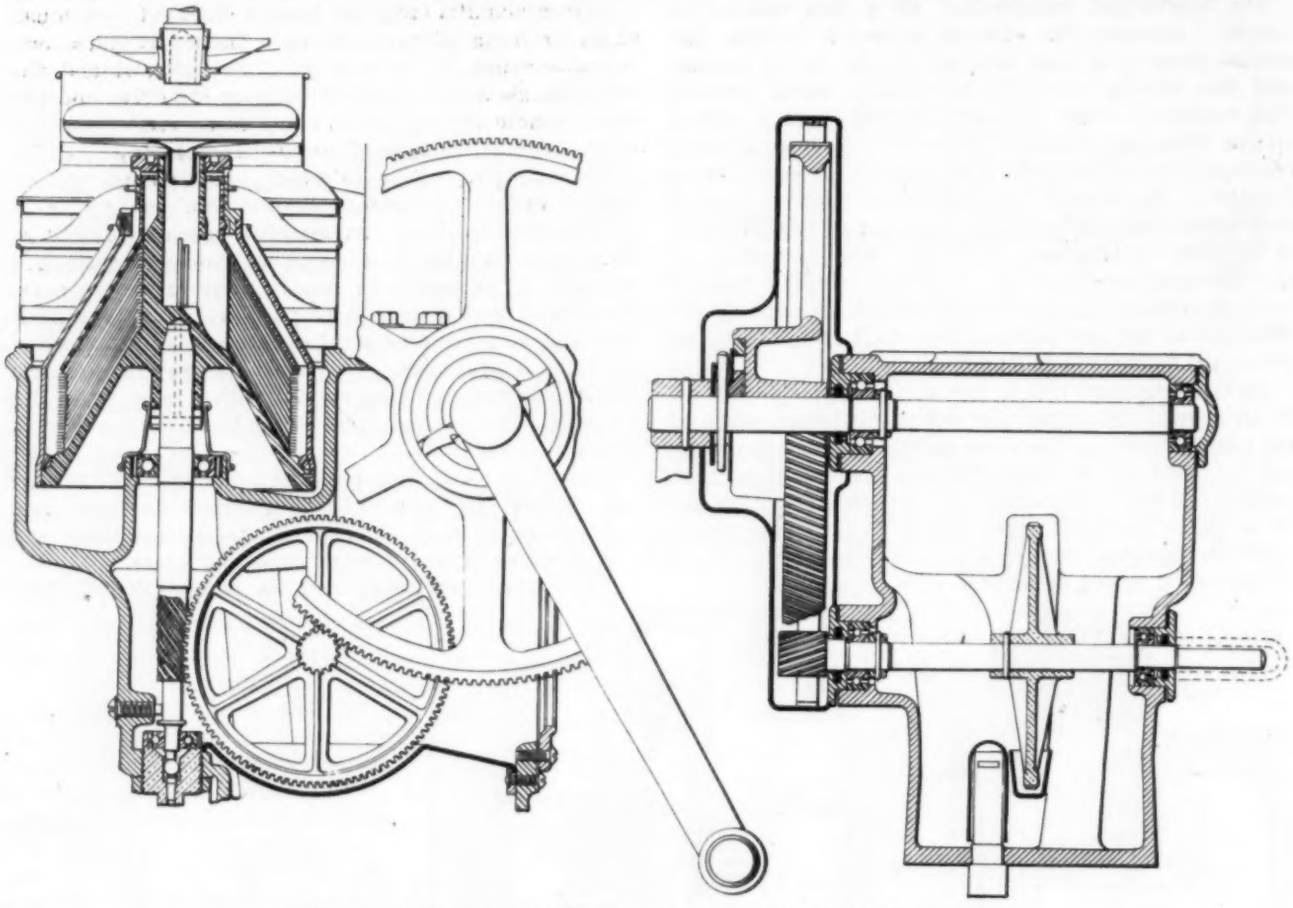


Fig. 6—A bearing installation that effected a decided saving

The high speed countershaft, Fig. 3, illustrates a simplification of the lubricating problem. Annular ball bearings are used to support the shaft assembly with the usual method of one bearing being locked to prevent any movement of the parts, while the other has a floating outer race, to provide for machining inaccuracies. Since the loose pulley in this case is of small diameter, it is mounted on one double angular-contact bearing which has both inner and outer races clamped. This mounting should not be employed where large diameter pulleys are used. By filling the interior of the bearing housing with grease at assembly, no attention will be required for an extended period and with efficient sealing methods, the assembly is adaptable wherever overlubricated high-speed boxes might cause damage by dripping down on the operator and his work.

Another example of an installation where the lubrication problem is troublesome is shown in Fig. 4, which illustrates a vertical shaft and drive-pulley support for a submerged centrifugal pump. Lubrication, in the case of a vertical shaft, is difficult when a plain bearing is used, but the method of mounting a ball-bearing inner race on a bushing, having an annular chamber which forms an oil well between a portion of its inner periphery and shaft, readily overcomes the problem.

If a plain bearing were used in this case, it would, no doubt, be used in combination with a ball-thrust washer. It is very obvious that one ball bearing and the simple lubricating reservoir costs considerably less than the plain bearing and the necessary ball-thrust washer, which latter is a makeshift at high speeds.

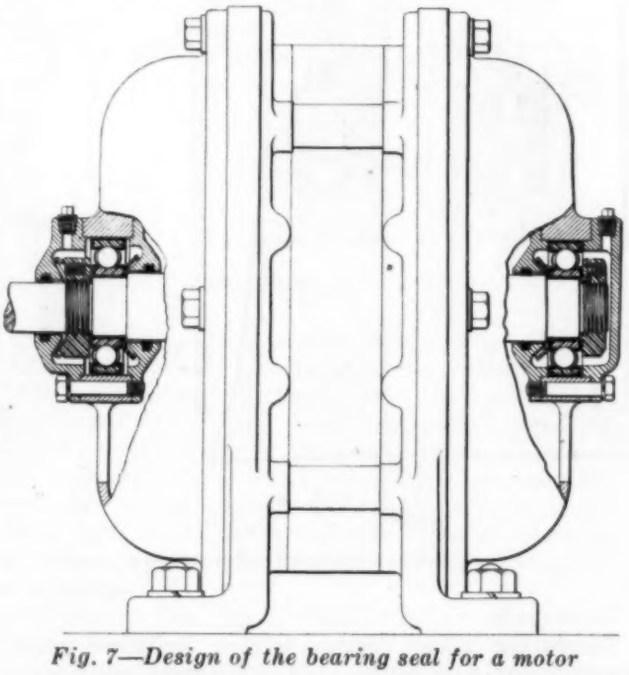


Fig. 7—Design of the bearing seal for a motor

In some cases where small electric motors are used, it is necessary to transmit every ounce of power from the motor to the tool. There is an almost direct connection between the ball-bearing motor shown in Fig. 5,

and the tapping spindle of the machine. The upper double angular-contact bearing resists the thrust loads from either direction, thus doing away with the need of double ball thrust collar and annular bearing.

As this is a friction-drive machine, it is essential that there be no leakage of the spindle lubricant. Otherwise, the efficiency of the friction drive would be disturbed. The ball bearings can be readily inclosed and grease lubricant used. Tests have shown that the application to the cream separator illustrated in Fig. 6 saved approximately 35 per cent of the power required by a plain-bearing machine.

An efficient type of seal is illustrated in Fig. 7. The grease grooves formed in the retaining members prevent the entrance of foreign matter and leakage of the lubricant. When operating in places where the heat is sufficient to thin the grease, it is of course more apt to escape from the housing and to prevent such an occurrence, slingers are provided just within the closure members. The function of these slingers is to throw the grease away from the shaft and not allow it to collect in too great a quantity around the seal.

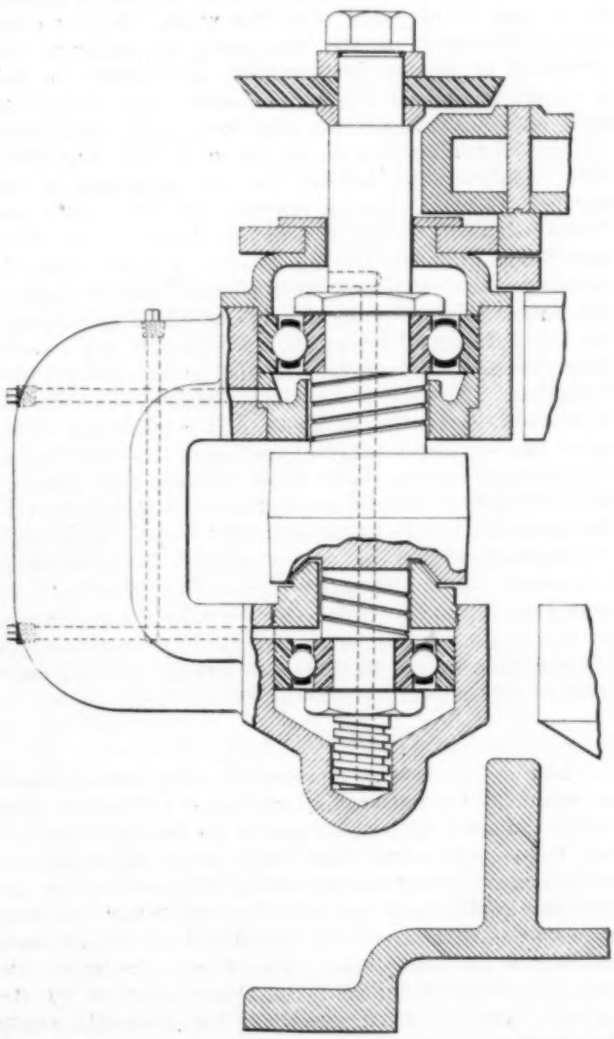


Fig. 8—Oil-circulating design for a high-speed shaft

The high speed ability of the ball bearing is well understood. Lubrication of this type of bearing is of importance, not because of the quantity required, as in a plain bearing, but because of the lesser amount which must be applied at the proper place. Too much lubricant in a ball bearing at high speeds causes failure due to heat generated by the churning action of the rotating parts. Too little will cause failure due to the building up of friction between the balls and cage or the separator which spaces them.

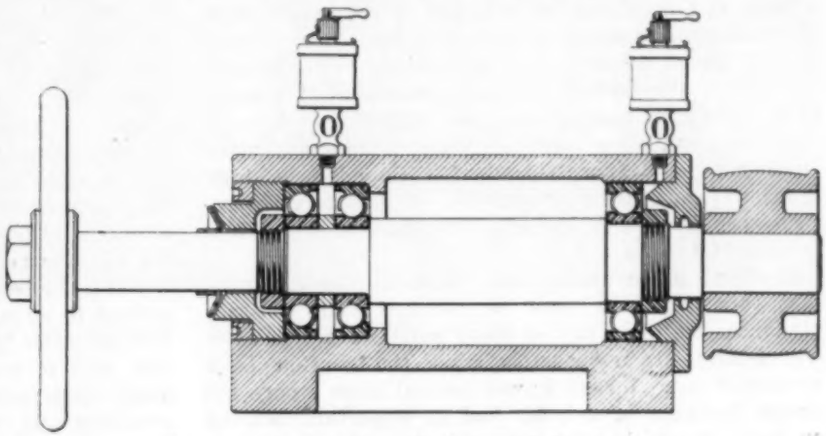


Fig. 9—A common mounting for a horizontal high-speed spindle

The high-speed bearing application may be either vertical or horiztonal. A method of lubricating a vertical spindle is shown in Fig. 8. This is a wood-working vertical spindle. An oil circulating system is used. The lower end of the spindle is fitted with a small clearance into an oil sump. In rotating, oil is forced from this sump through the center of the shaft, thence to the upper bearing and from there back through the lower bearing to the reservoir to be recirculated.

The most common horizontal-spindle mounting consists, at the wheel end, of two opposed angular-contact bearings mounted with a spacer between them, the inner race being pressed on the shaft and locked as in Fig. 9. The outer races are slidable so that all the initial play can be taken out and, in fact, a slight tension imposed.

It will be noted that this mounting provides a space between the outer races through which oil is fed directly to the bearings themselves rather than allowed to drip on the shaft some distance away from the bearing.

This method of feeding the oil to the shaft is often tried but is not satisfactory, due to the fact that the housing is frequently of greater diameter between the bearings than at the bearings themselves. Therefore, under the action of centrifugal force, the oil is thrown to the housing's largest diameter and very little ever reaches the bearing unless over-lubrication is resorted to, resulting in either case in bearing failure.

By careful consideration of the lubricating problem, which is of more importance in a ball bearing than is generally believed, it is possible to operate ball-bearing spindles at speeds in excess of 25,000 r.p.m. and obtain satisfactory service.

In conclusion, it should be said that the producers of ball bearings maintain engineering departments whose engineers stand ready to work out and recommend the most efficient application to any particular unit.

The Interpretation of Contracts

By Kendall Hereford

ENGINEERS are constantly called upon to enter into contracts of which the vast majority are made without the assistance or guidance of a lawyer. Most of them are completed by correspondence and contain none of the ritual of the formal contract. It is an easy matter for the layman to unconsciously bind himself to an agreement that is sometimes difficult to interpret, sometimes capable of different constructions and often binding to a degree beyond that intended by him. Ignorance of the consequences of ordinary correspondence frequently leads to situations from which it is difficult to escape.

It ought to be unnecessary to make the statement that correspondence must be watched with constant vigilance, yet there are so many suits for which careless letters are responsible, that the caution is a necessary one. I have known several cases where the simple ignoring of a letter had an important bearing on suits in which correspondence figured. It is easy to deliberately misconstrue a letter and to bind its writer to definite obligations where none were intended, unless the reply simply prohibits adverse constructions and makes certain the writer's position.

Law, it must be remembered, is an artificial, man-made thing. In its turn it creates perfectly arbitrary and artificial rules often directly in conflict with those expected by the layman. Sometimes these rules are illogical, but usually there is a reason behind them, and they are so laid down because of the necessity for rigid, black and white testing of cases. It is this limitation in law that makes accurate expression of intention, and no more, necessary in all correspondence leading to contractual relations.

Unwritten Terms Sometimes Binding

If the layman realized the liabilities he assumes in conditional contracts, he would be more wary of the terms of his contracts. If the contractor alone prepares the terms of the agreement, any doubtful wording will be construed against him by the court as in Wilson vs. Cooper, 95 Fed. 625. This situation applies mainly to contracts formally drawn up. The contract should fully and clearly express the intention of the parties, but should include nothing more than this. Any personal understandings included are likely to become binding even when they were not so intended.

Whenever a contract will be void according to one interpretation, the courts will, if possible, avoid such an interpretation and adopt one that will support the contract, although the court cannot substitute another for the one entered into by the parties. It will not construe one where there was none before, nor exchange one working a hardship for a lenient one unless there are good grounds on which this can be legally done. (Burwitz vs. Jeffries, 103 Mich. 512 and 515). Nevertheless the court has a tendency to shape the interpretation of contracts according to fixed rulings found in precedents. These rulings are often widely variant from the terms really existant in the contract. An example will be found in the New York cases dealing with contracts containing such a condition as "satisfaction guaranteed" to the promisee. This condition will be discussed later.

If one party, through the fault of the other, fails to perform his side of the contract, or to complete it after it has begun, the law implies a promise to pay such a remuneration as the benefit conferred is reasonably worth. In Hayward vs. Leonard, 7 Pick. 181, the execution of a construction job varied from the terms of the original written contract. The defendant, for whom the house was being built, was present during practically the entire building operations. He had an opportunity to see all the labor and materials in the work. He objected to some materials and work, but continued supervision and himself ordered some changes from the written contract. He expressed himself as satisfied with a part of the work from time to time, but when the house was finished he refused to accept it. The court held that the builder could recover for his labor and materials. Of course, here satisfaction may have been implied from the fact that he yielded to changes and allowed the work to continue. This situation is just as applicable in engineering practice, and it must be remembered that yielding will imply satisfaction no matter if the yielding is a grudging one, when work is allowed to continue. In correspondence also, failure to answer claims contained in a letter may be construed as being an acceptance or admission of their truth.

Honest Judgment

Contractors often agree to perform with payment to be made subject to the satisfaction of the promisee, or of some third party, with the work. In this case, such a promise is usually interpreted as requiring the promisor to render performance satisfactory to the promisee *if he uses honest judgment*, even though no such qualifying phrase was contained in the agreement. (Silsby Manufacturing Co. vs. Chico, 24 Fed. Rep. 893.) The promisee must actually use his judgment on the matter. If he refuses to examine the promisor's performance, as in Sidney School Furniture Co. vs. Warsaw School District, 130 Pa. St. 76, or if he bases his rejection in reality not on its unsatisfactory nature but on fictitious grounds or none at all as in Richardson vs. Coffman, 87 Iowa, 121, his rejection will amount to prevention of performance and so excuse the performance. This will constitute breach of contract. New York, as mentioned above, and many other states place an entirely different meaning on the words "satisfaction guaranteed" from the meaning actually there. Such a phrase as "satisfaction guaranteed to the promisee before payment" will mean no more than "performance such as would satisfy the reasonable judgment of a reasonable man." Gladding vs. Montgomery, 20 Calif. App. 276; Fuchs & Lang Manufacturing Co. vs. Kittredge, 242 Ill. 88; Union League Club vs. Blymer Ice Machine Co., 204 Ill. 117, are cases holding this view.

The Viewpoint of Law

There are an infinite number of cases that will serve as examples to caution the contractor to put no more in his contract than he means to be bound to, and to say it in such a way that there is no mistaking his intention. Correspondence should be watched to see that no implications are left that will alter the final appearance of the contract. Finally, it must be remembered that the consequences placed on contracts by law are frequently different from those expected by the layman, and he must see that his contracts really express legally what he means.

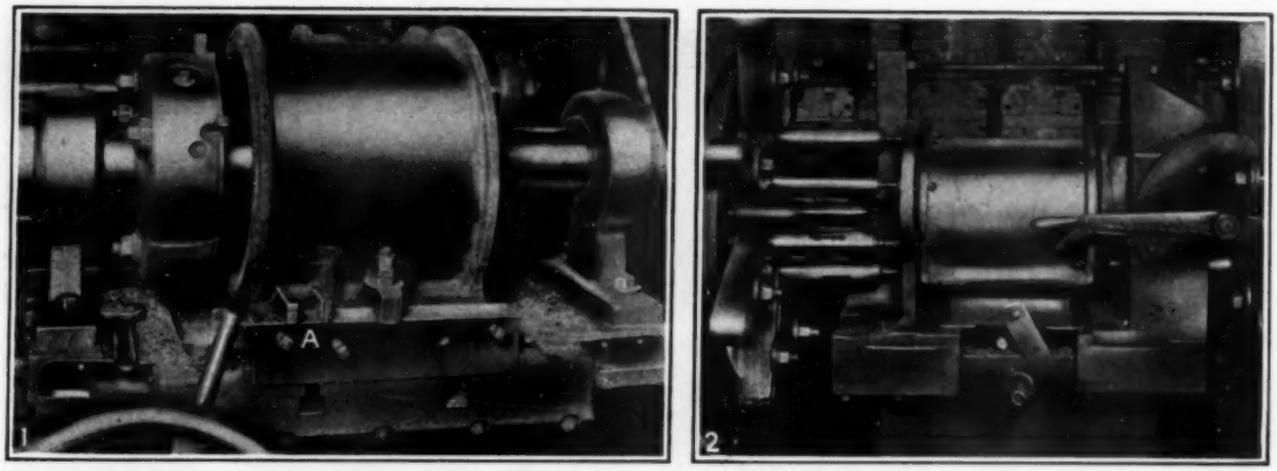


Fig. 1—Boring and facing a brake cylinder. Fig. 2—Drilling both ends in a special machine

Westinghouse Brake Cylinders and Auxiliary Reservoirs

By Fred H. Colvin
Editor, *American Machinist*

Some of the methods shown date back far enough to show that this plant was always alive to the value of special machines

AMONG the simpler parts of the air brake apparatus manufactured by the Westinghouse Air Brake Co., Wilmerding, Pa., are the brake cylinder and auxiliary reservoir for freight equipment. The brake cylinder must, of course, function when air is admitted to it in order to apply the brake to the locomotive or car on which it is placed. The machining of the brake cylinder is a comparatively simple operation, one being shown in position on its machine in Fig. 1. Here the fixture is built on the lathe carriage, suitable supports being mounted at each end so that the boring bar may be guided accurately as the cylinder is fed toward the headstock of the machine. The type of boring head is plainly shown, two of the boring tools being replaced by a chamfering tool in front and a facing tool at the top. Two of the boring tools are shown in front of the fixture at *A*.

The two end flanges are drilled simultaneously on the double-head machine shown in Fig. 2. The construction of the fixture holding the cylinder is clearly shown, the tie rod at the top overcoming any tendency to spring when the work is clamped between the two heads. The support at the right is fitted with an adjustable plunger which allows the work to be put in place and readily removed. The plunger is controlled by the lever shown, the quadrant allowing considerable leeway in adjustment. With the lever in a vertical position, the plunger is withdrawn from the work.

The auxiliary reservoir requires facing at each end only and no deep boring is necessary. The reservoir is machined in a special lathe, as shown in Fig. 3. It is held in a hollow spindle in the center of the lathe bed, a lathe carriage and turret being mounted at each end. The work is driven through a gear that surrounds the hollow spindle, and the two carriages are provided with power cross feeds for facing the ends of the reservoir. The machine shown was built by the Bullard Machine Tool Co. of Bridgeport before it began specializing on machines of the boring mill family, thus giving some idea of the early date at which this method of machining was devised. The operation is still being continued with very satisfactory results.

The small end of the reservoir is drilled and tapped on the station-type machine shown in Fig. 4. In reality, the machine comprises two vertical drilling machines placed close together and having a common work table with three stations. The table is so located that two of the stations are always under the two drilling spindles. The front station is for loading and unloading, the drilling and tapping being done by the three-spindle heads shown at the other two stations. This combination makes a very simple and effective unit and has proved very satisfactory.

The other end of the auxiliary reservoir is drilled in a special drilling machine of the inverted type, the business end of the machine being shown in Fig. 5. The work is handled by an air hoist, and after being lowered on the table of the machine, is clamped as

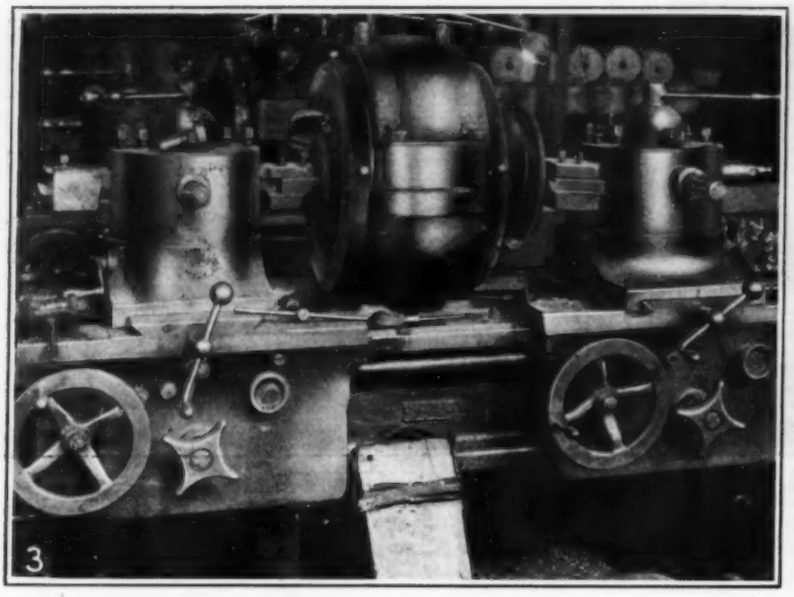


Fig. 3—Facing the ends of auxiliary reservoir in double-ended lathe

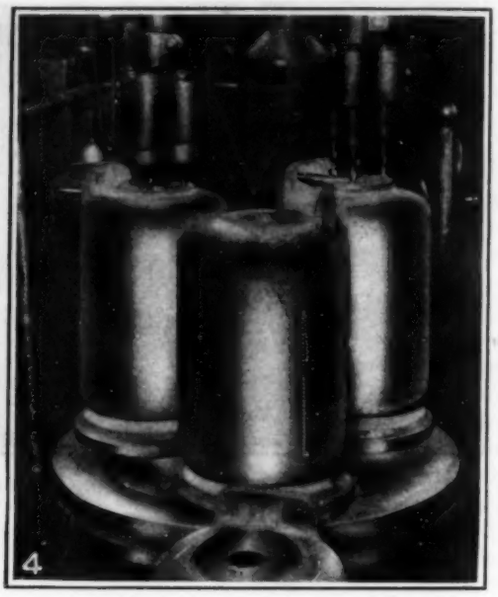
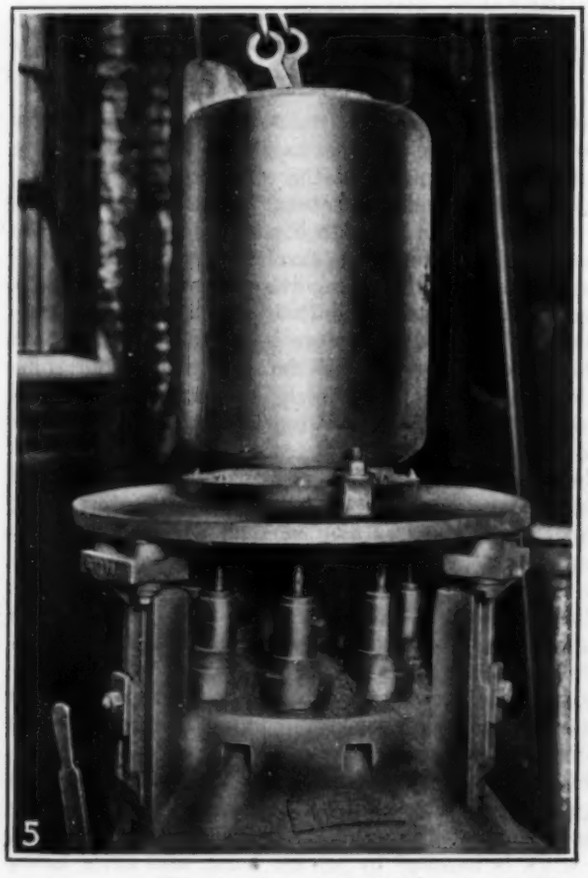


Fig. 4—Drilling and tapping machine

shown. The eight inverted drills then feed up to the work; the illustration showing them having just broken through the flange. This machine handles the work very rapidly and requires no special fixture, since the drills are guided by the machine itself.

Another operation in connection with the auxiliary reservoir is the testing for leaks, and to be sure that they will safely stand the required pressure. As can be seen at the base of the testing machine in Fig. 6, a roller conveyor is provided so that the reservoirs can be easily handled on off the testing machine. The heavy steel shell *A* is lowered over the reservoir and air pressure applied. The reservoirs are of course, tested to considerably higher pressures than that to which they will be subjected when in use. The steel shell is to prevent the pieces from flying in case of breakage. After passing the high-pressure test, the reservoirs are coated with soap suds to detect air leaks and are then ready to pass on for painting and to have the proper connections attached to the ends.



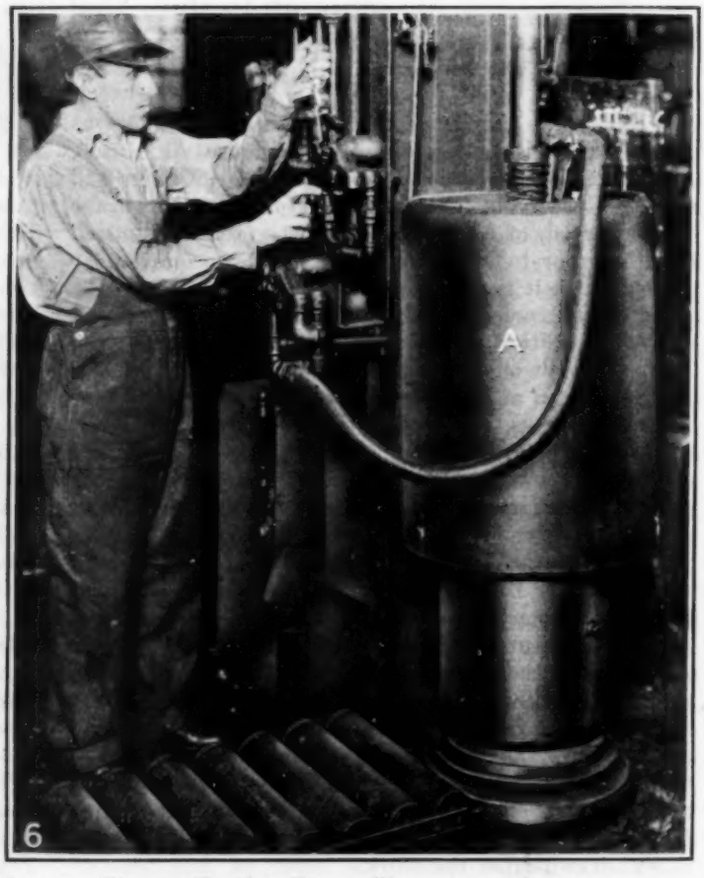


Fig. 5—Inverted machine for drilling flange. Fig. 6—Testing the auxiliary reservoirs

Standardizing Punch and Die Parts

By Edward Heller

Press tools of different types—Components for replacement carried in stock—Methods of holding small punches and dies interchangeably—A press chart

IF MANUFACTURERS of stampings will establish standards for their various punch and die components, the making of their press tools will be rendered much simpler and cheaper, and considerable time will be saved in the designing department.

While the standards shown in the accompanying illustrations may not fit any particular shop, they represent a fair collection of what might be used in the average shop. With a few additions and modifications they can be made to fit almost any shop.

Die Shoe No.	A	B	C	D	E	Mat'l	Number to be Kept in Stock	Patt'n No.
1	6	4	1¾	2	10	C.I.	4	
2	8	6	1¾	2	12	C.I.	4	
3	10	8	2	2	14	C.I.	3	
4	12	8	2	2½	16½	C.I.	2	
5	16	14	2½	2½	20½	C.I.	1	
6	6	4	1¾	2	10	Steel Cast'g	1	
7	8	6	1¾	2	12	Steel Cast'g	1	
8	10	8	2	2	14	Steel Cast'g	1	
9	12	8	2	2½	16½	Steel Cast'g	1	
10	16	14	2½	2½	20½	Steel Cast'g	1	

Note For stock, finish bottom face only

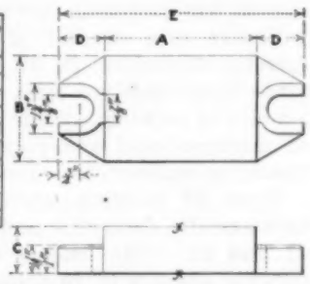


Fig. 1—Rectangular die shoes

In designing dies, the first things to be considered are the die shoes and punch holders. These components are generally divided into four kinds and will be considered singly.

A set of rectangular die shoes is shown in Fig. 1. These shoes are usually used for the most simple dies and particularly for dies that have no cutting edges. They are generally made in sizes ranging from 6x4 in. to 16x14 in. While these sizes might be suitable for the average shop, one shop might find a need for a narrow and extra long die shoe, while another might find no use whatever for a certain size given on the list. The quantities in the column "Number to be kept in stock" are relative only. One shop might find it necessary to double or triple the amount, while another might find that the quantities given are too large. The method usually employed is to adopt a figure that is put in the table to represent the minimum to be kept in stock.

The column "Pattern No." has been left blank. Practically every shop has a system of its own regarding pattern numbers, and it was thought best to leave that part open.

In Fig. 2 is shown a set of punch holders to be used as mates to the die shoes in Fig. 1. A punch holder of this particular type, but of a smaller size, might be used with a die shoe of the next larger size.

Punch Holder No.	A	B	C	Mat'l	Number to be Kept in Stock	Patt'n No.
21	6	4	1¾	C.I.	6	
22	8	6	1¾	C.I.	6	
23	10	8	2	C.I.	3	
24	12	8	2	C.I.	2	
25	16	14	2½	C.I.	1	
26	6	4	1¾	Steel Cast'g	4	
27	8	6	1¾	Steel Cast'g	4	
28	10	8	2	Steel Cast'g	3	
29	12	8	2	Steel Cast'g	2	
30	16	14	2½	Steel Cast'g	1	

Note For stock, finish upper face only

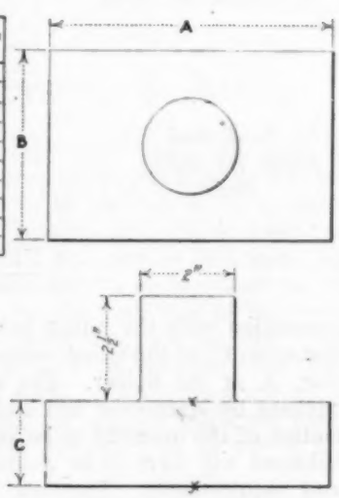


Fig. 2—Rectangular punch holders

Die Shoe No.	A	B	C	D	E	F	G	H	Mat'l	No. to be Kept in Stock	Patt'n No.
41	10	6	1¾	2	14	8	1¼	1	C.I.	3	
42	14	8	1¾	2	18	11	1¼	1	C.I.	2	
43	18	12	2	2½	22½	16	2	1	C.I.	1	
44	10	6	1¾	2	14	8	1¼	1	Steel Cast'g	1	
45	14	8	1¾	2	18	11	1¼	1	Steel Cast'g	1	
46	18	12	2	2½	22½	16	2	1	Steel Cast'g	1	

Note For stock, finish bottom face only

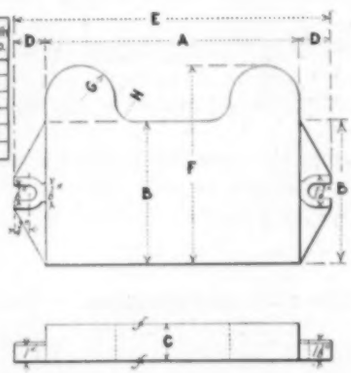


Fig. 3—Die shoes for pillar tools

And that is very often done, since the die usually requires more room for the location of stops, gage pins, etc. It is for this reason that the quantities given in the column "No. to be kept in stock" for punch holders Nos. 21 and 22 are larger than the quantities given for the corresponding die shoes.

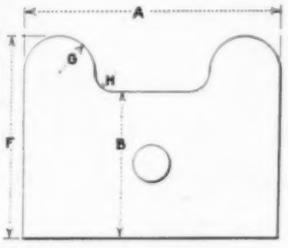
The stems of all punch holders are finished to 2 in. in diameter by 2½ in. long. This diameter is suitable for nearly all presses now on the market. There are a few presses that have smaller holes in the rams, and for those the stems can be turned to the proper diameter. The length, 2½ in. is arbitrary, but it is a length that is almost universally used. There are a few shops that prefer to make the length 2¾ in., and even as short as 2 in., but the 2½-in. length gives a better grip, and for heavy punches it is preferred.

Castings for die shoes and punch holders, provided with ears for guide-pins, are shown in Figs. 3 and 4. Castings of this type may be used on all dies that

have cutting edges, and also on forming or bending dies that have delicate parts. The general features of these castings are practically the same as of the ones shown in Figs. 1 and 2. For very small blanking or piercing dies, a plain rectangular set of castings may be used, and guide pins may be put in at any conven-

Punch Holder No.	A	B	C	F	G	H	Mat'l	Number to be Kept in Stock	Patt'n No.
51	10	6	1⅜	6⅜	1½	¾	C.I.	3	
52	14	8	1⅜	11	1⅜	1	C.I.	2	
53	18	12	2	16	2	1	C.I.	1	
54	10	6	1⅜	6⅜	1½	¾	Steel Cast'g	3	
55	14	8	1⅜	11	1⅜	1	Steel Cast'g	2	
56	18	12	2	16	2	1	Steel Cast'g	1	

Note: For stock, machine upper face only



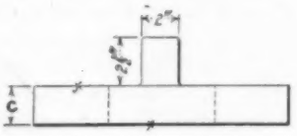
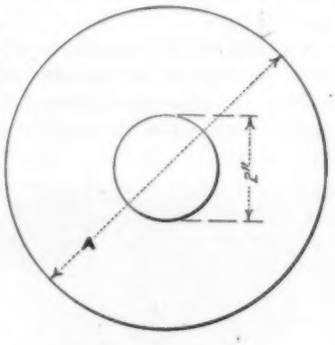


Fig. 4—Punch holders for pillar tools

ient points. Large blanking dies that require large clearance holes to let the blanks drop through, are weakened considerably and had better be made of steel castings to avoid extra size and weight. The plain, round, die shoes shown in Fig. 5 are used largely for

Die Shoe No.	A	B	Mat'l	Number to be Kept in Stock	Patt'n No.
71	3	1⅜	C.R.S.	2	
72	4	1⅜	C.R.S.	2	
73	6	1¾	C.I.	3	
74	8	1¾	C.I.	2	
75	10	2	C.I.	1	
76	18	1⅞	St'l cast'g	1	
77	10	2	St'l Cast'g	1	

Note: For stock, finish upper face only



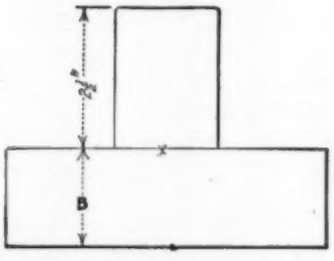


Fig. 5—Round die shoes

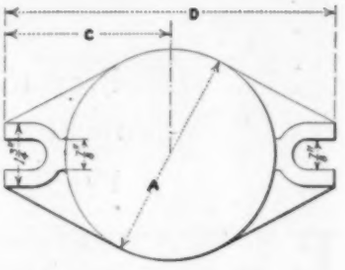
redrawing dies for round shells, or for forming operations on work that is circular or nearly so. Two or three sizes of die shoes of this kind will cover most of the requirements of the average shop. The punch holder Fig. 6, on the other hand, might be carried in more sizes than the shoes. One or two smaller sizes might be found useful, for in this kind of tool the punch holder and die shoe do not always have to be a match.

It will be found that very small sizes of punch holders can be made more cheaply from cold-rolled steel than from cast iron, and will obviate the necessity of making patterns and waiting for castings. The punch holders and die shoes shown in Figs. 7 and 8 are round castings having lugs for guide pins and bushings. Such castings are used largely for combination blanking and drawing dies or for dies for circular work, when cutting edges form any part of the tools.

The next things to consider are the guide pins and bushings as shown in Figs. 9 and 10. On ordinary work, guide pins from $\frac{1}{8}$ to $1\frac{1}{4}$ in. in diameter can be used. The $\frac{1}{8}$-in. size is used but seldom and then on very light work only. For this reason very few of them need be kept in stock. The diameters of the

Die Shoe No.	A	B	C	D	Mat'l	Number to be Kept in Stock	Patt'n No.
63	6	1⅜	4⅜	9½	C.I.	3	
64	8	1⅜	6	12	C.I.	2	
65	10	2	7	14	C.I.	1	
66	8	1⅜	6	12	Steel Cast'g	1	
67	10	2	7	14	Steel Cast'g	1	

Note: For stock, machine lower face only



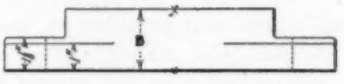


Fig. 6—Round punch holders

finished pins are such that they can be turned from standard sizes of stock with little waste. At least two lengths for each diameter may be kept in stock. This will take care of dies of varied shut-heights. The extreme diameters, *D*, of the guide bushings may be made from standard sizes of bar stock with the least amount of turning. While guide bushings can be made of machine steel and pack hardened, the guide pins should be made of tool steel, hardened and ground.

Types of piercing-punch holders that may be new to many die designers and users, are shown in Figs. 11 and 12. The holders shown in Fig. 11 are for punches above $\frac{1}{4}$ in. in diameter, while those in Fig. 12 are for sizes $\frac{1}{4}$ in. and smaller. The difference is that each holder shown in Fig. 12 is used for but one size of punch, while the ones tabulated in Fig. 11 are used for a number of sizes. Thus No. 131 punch holder can be used for punches from $\frac{1}{4}$ to $\frac{3}{8}$ in. inclusive; No. 133 from $\frac{3}{8}$ to $\frac{7}{16}$ in., and so forth. They are usually stocked in two or more lengths to take care of varying conditions of dies.

The piercing punches shown in Fig. 13 are used in

Die Shoe No.	A	B	C	D	E	F	Mat'l	Number to be Kept in Stock	Patt'n No.
61	6	1⅜	4⅜	2	9½	4⅜	C.I.	2	
62	8	1⅜	5⅝	2½	11½	5⅝	C.I.	2	
63	10	2	7	3	14	7	C.I.	1	
64	10	2	7	3	14	7	St'l Cast'g	1	

Note: For stock, finish bottom face only

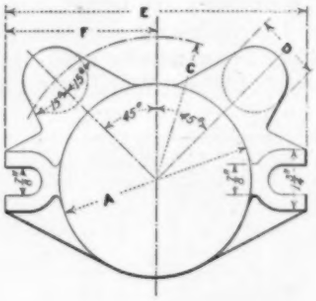


Fig. 7—Round die shoes for pillar tools

connection with the punch holders Fig. 11. The body diameter, *C*, of the punch corresponds to the hole diameter, *A*, of the holder. The sizes shown in the table advance by sixteenths and eighths of an inch. In the matter of the quantity to be kept on hand, every establishment will have to be guided by its own experience and requirements. Piercing punches should be kept

in stock for every punch that is in operation in a die. The number to be kept on hand should be in inverse proportion to the ratio of the thickness of the stock punched and the diameter of the punch. A ¾-in. punch working in ⅛-in. stock will last a long time with average care. One extra punch in stock will generally answer for a dozen punches in use. But a ¼-in. punch going through ⅜-in. stock is liable to break at any time, and one extra punch in stock for each punch in actual use is none too much. The punches should be made of the best tool steel obtainable and can be made from standard sizes of stock.

The piercing punches shown in Fig. 13 should be made from drill-rod of the required size, and have the ends peened over to suit the punch holders shown in Fig. 12. These sizes of punches are the ones that break most often, but they are easiest to make and a good supply will not cost very much.

The piercing dies shown in Fig. 15 are to be used in connection with the punches shown in Figs. 13 and 14. The dimension, *A*, for the holes, is in all cases figured to give the proper clearance for the maximum

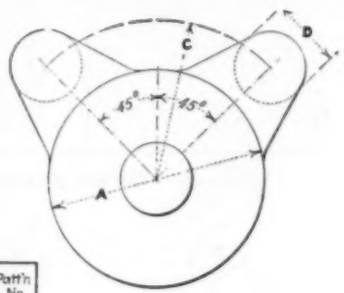
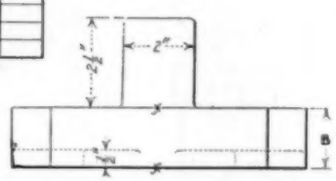


Fig. 8—Round punch holders for pillar tools

Punch Holder No.	A	B	C	D	Mat'l	Number to be Kept in Stock	Patt'n No.
91	6	1⅞	4½	2	C.I.	2	
92	8	1¾	5⅛	2½	C.I.	2	
93	10	2	7	3	C.I.	1	
94	10	2	7	3	Steel Casting	1	

Note: For stock, finish upper face only



Pin No.	A	B	C	D	E	Number to be Kept in Stock
111	7/16	4½	½	1/16	1/32	2
112	7/16	4½	½	1/16	1/32	6
113	9/16	5⅛	½	1/16	1/32	4
114	1⅜	5	½	1/16	1/32	4
115	1⅜	5⅛	½	1/16	1/32	4
116	1⅜	6½	½	1/16	1/32	2
117	1⅜	5½	⅝	3/32	3/64	2
118	1⅜	6½	⅝	3/32	3/64	2
119	1⅜	7	⅝	3/32	3/64	2
120	1⅜	6½	¾	3/32	3/64	2
121	1⅜	7½	¾	3/32	3/64	2
122	1⅜	8½	¾	3/32	3/64	2

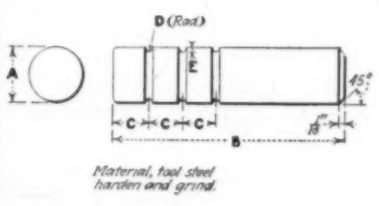


Fig. 9—Guide pins for pillar tools

sizes of stock. Nearly all shops use a clearance of 10 per cent of the thickness of the stock to be pierced. Thus, if a ¼-in. hole is to be pierced in ⅛-in. stock, the hole in the die will be $0.250 \times (0.10 \times 0.062) = 0.256$ in. However, no flat rule can be laid down for the clearance, since it depends to a great extent on the quality of the material, and the condition of the press used. But for average conditions, die No. 203 could be used for stock from ⅛ to ⅜ in. without much difficulty, while die No. 204 could be used for stock up to ¼-in. thick. Dies intended for heavier stock are made heavier all around, so they will stand up as well as the dies for light stock.

A typical section of a punch and die is shown in Fig. 16. *A* is the punch holder; *B*, the punch plate; *C*, one of the threaded punch holders shown in Fig. 11; *D*, a piercing punch of the type shown in Fig. 13. *E* is the stripper plate; *F* is the die shown in Fig. 15; *G*, the die plate; and *H*, the die shoe.

Blanking and piercing dies are usually made in one

Bushing No.	A	B	C	D	E	Number to be Kept in Stock
101	3/16	1⅛	1 3/16	1⅜	1⅛	2
102	3/16	1 3/16	1⅜	1⅜	1½	10
103	1⅜	1⅜	1⅜	1⅜	1½	10
104	1⅜	1⅜	1⅜	2⅛	1½	6
105	1⅜	1⅜	2⅛	2⅛	2	6

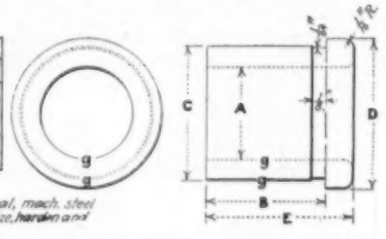


Fig. 10—Guide bushings for pillar tools

Punch Holder No.	A	B	C	D	E	F	G	No to be Kept in Stock
131	¼	1¼	¼	⅜-18	¾	¼	⅛	3
132	¼	2	¼	⅜-18	1¼	¼	⅛	2
133	⅜	1¼	¼	⅜-18	1⅛	¼	⅛	3
134	⅜	2	¼	⅜-18	1⅛	¼	⅛	2
135	½	1¼	⅛	½-14	1⅛	⅜	⅛	2
136	½	2¼	1¼	½-14	1⅛	⅜	⅛	2
137	⅛	1¾	1¼	⅛-10	1	½	⅛	1
138	⅛	2¼	1¼	⅛-10	1¼	½	⅛	1

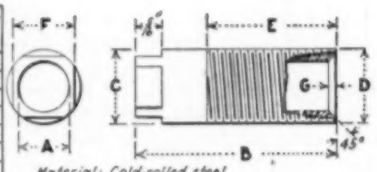


Fig. 11—Threaded punch holders

of three ways. One way is as shown in Fig. 16. Here the punch is on top while the die is below and the stripper is suspended from the punch holder. The second method is to have the punch and die in the same relative position as shown but with the stripper fastened permanently to the die. This construction is generally used for working strip stock. The third method seldom used, is to have the punch and die reversed, that is the punch is in the die shoe and the die in the punch holder.

Method two is one that lends itself best to the use of threaded punch holders. The various punches are held in punch holders and they in turn are held in

Punch Holder No.	A	B	C	Number to be Kept in Stock
151	⅛	1¼	7/16	3
152	⅛	2 1/16	1¼	2
153	5/16	1½	11/16	3
154	5/16	2 1/16	1⅛	2
155	¼	1½	11/16	2
156	¼	2 1/16	1¼	2

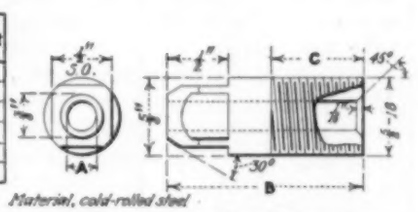


Fig. 12—Threaded holders for drill-rod punches

Punch No.	A	B	No. to be Kept in Stock
191	⅛	2	8
192	⅛	2½	8
193	3/16	2	6
194	3/16	2½	8
195	¼	2	6
196	¼	2½	6

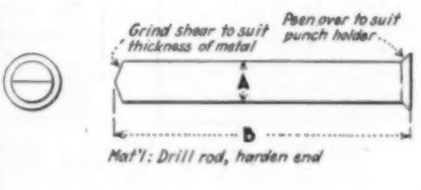


Fig. 13—Drill-rod piercing punches

the punch plate *B*. If one of the piercing punches breaks, the punch holder can be unscrewed from the plate, the shank of the broken punch pushed out, another one inserted and the whole screwed into the

punch plate. In about ten minutes at the most, the press will again be ready for business.

Method three is generally used for very large blanking and piercing dies, where the main die, the piercing punches and the part stripper are combined on one

Punch No.	A	B	C	D	E	F	No. to be Kept in Stock
161	1/16	2	1/8	1/4	1/16	1/16	4
162	1/16	2 1/4	1/8	2	1/16	1/16	2
163	1/16	2	1/8	1/8	1/16	1/16	4
164	1/8	2 1/4	1/8	2	1/16	1/16	2
165	1/16	2	1/8	1 1/4	1/16	1/16	3
166	1/16	2 1/4	1/8	2	1/16	1/16	2
167	1/8	2	1/8	1 1/4	1/16	1/16	2
168	1/8	2 1/4	1/8	2	1/16	1/16	2
169	1/8	2 1/4	1/8	1 1/4	1/8	1	2
170	1/8	3	1/8	2 1/4	1/8	1	2
171	1/8	2 1/4	1/8	1 1/4	1/8	1	1
172	1/8	3	1/8	2 1/4	1/8	1	1
173	1/8	2 1/4	1/16	1 1/2	1/8	1 1/8	1
174	1/8	3 1/4	1/16	2 1/4	1/8	1 1/8	1
175	1	2 1/4	1/16	1 1/2	1/8	1 1/8	1
176	1	3 1/4	1/16	2 1/4	1/8	1 1/8	1
177	1/16	2 1/4	1/16	1 1/2	1/8	1 1/8	1
178	1/16	3 1/4	1/16	2 1/4	1/8	1 1/8	1

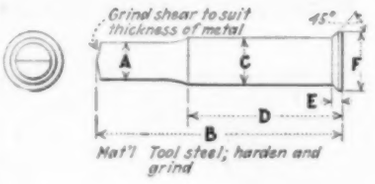


Fig. 14—Piercing punches

bolster on the bed of the press. In this case the punch secured to the ram is provided with piercing dies having clearance at the top or side for the small blanks. At any rate, in this kind of a die the piercing punches are covered with a large stripper plate, and they are hard to get at. To remedy the situation, the stripper plate may be made of heavy material and laid into the die without any fastening. At convenient places holes are drilled and tapped in the plate, and when it becomes necessary to replace a punch, the stripper plate can be lifted off by means of screw eyes put into the tapped holes, and the punch replaced as described before.

All the tools so far described are of round outline.

Die No.	A	B	C	D	Number to be Kept in Stock
201	0.131	3/4	5/8	3/4	8
202	0.196	3/4	5/8	3/4	7
203	0.254	3/4	5/8	3/4	3
204	0.259	3/16	3/4	7/8	3
205	0.318	3/4	7/8	1	2
206	0.337	13/16	1	1 1/8	2
207	0.381	13/16	1	1 1/4	2
208	0.405	13/16	1 1/8	1 1/4	2
209	0.444	13/16	1	1 1/8	2
210	0.467	13/16	1 1/4	1 3/8	2
211	0.500	13/16	1 1/4	1 3/8	2
212	0.530	1 1/8	1 3/8	1 1/2	2
213	0.635	13/16	1 3/8	1 1/2	1
214	0.655	1 1/8	1 3/8	1 3/4	1
215	0.760	15/16	1 1/2	1 3/8	1
216	0.785	1 1/8	1 3/4	1 7/8	1
217	0.885	13/16	1 3/4	2	1
218	0.910	1 1/8	2	2 1/8	1
219	1.010	13/16	2	2 1/8	1
220	1.040	1 1/8	2 1/4	2 3/8	1
221	1.135	13/16	2 1/4	2 3/8	1
222	1.165	1 1/8	2 1/4	2 3/8	1

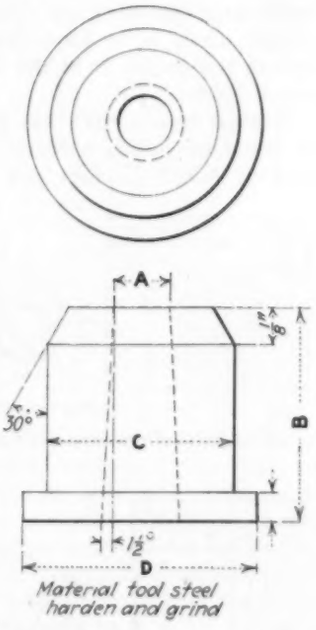


Fig. 15—Piercing dies

Occasionally, however, a square or oval hole must be pierced, and it will be well to provide for this. In so far as the shank dimensions of punches and external dimensions of dies are concerned, the same proportions as for round ones can be used, except that the largest dimension of the hole, such as the diagonal of a square or rectangular, or the major axis in an oval hole, as at

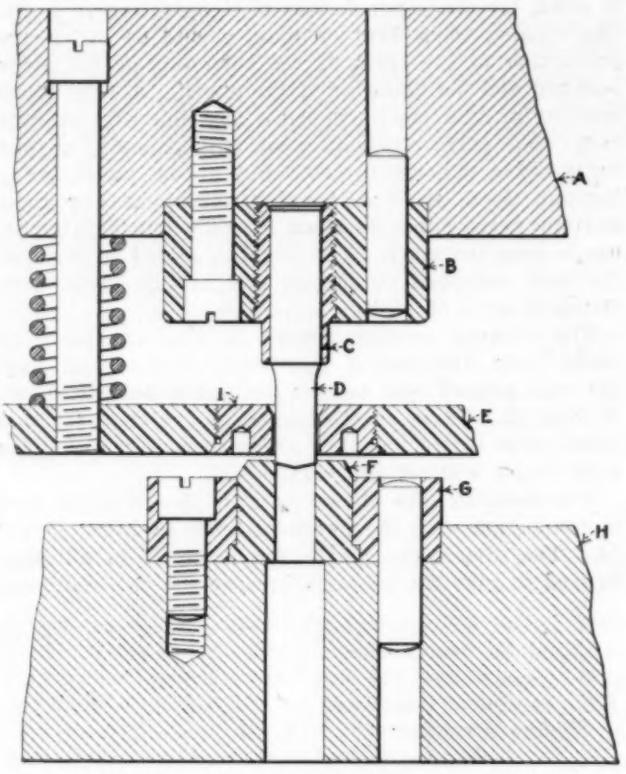


Fig. 16—Typical punch and die section

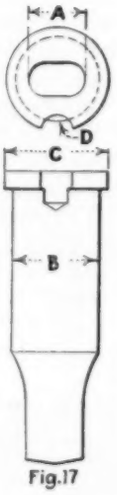


Fig. 17

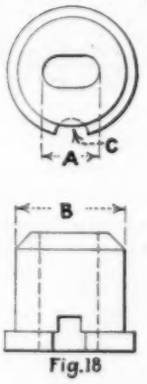


Fig. 18

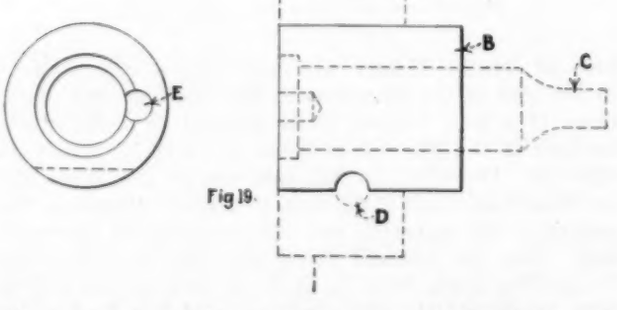


Fig 19.

Figs. 17 and 18—How irregular punches and dies are held from turning. Fig. 19—Removable punch holder for irregularly-shaped piercing punches

A in Fig. 17, should be considered when designing the tools and proportioning the dimensions *B* and *C*. The screwed punch holders shown in Figs. 11 and 12 cannot be used. In their stead, a holder such as the one shown in Fig. 19 is employed. The principal feature of this holder is that when it and its punch are finally located in the punch plate, they can be taken out and replaced in the exact position they were originally.

The irregular punch shown in Fig. 17 has a flat flange instead of the beveled one shown on the round punches. A half hole is milled or jig drilled at a certain spot, *D*. The punch holder has a corresponding half hole to the one in the punch. When the two are put together, a pin is pushed in into the hole formed by the two halves, acting as a key. The holder *B*, Fig. 19, is inserted in the punch plate *A*, and rotated carefully till the punch corresponds to its piercing die.

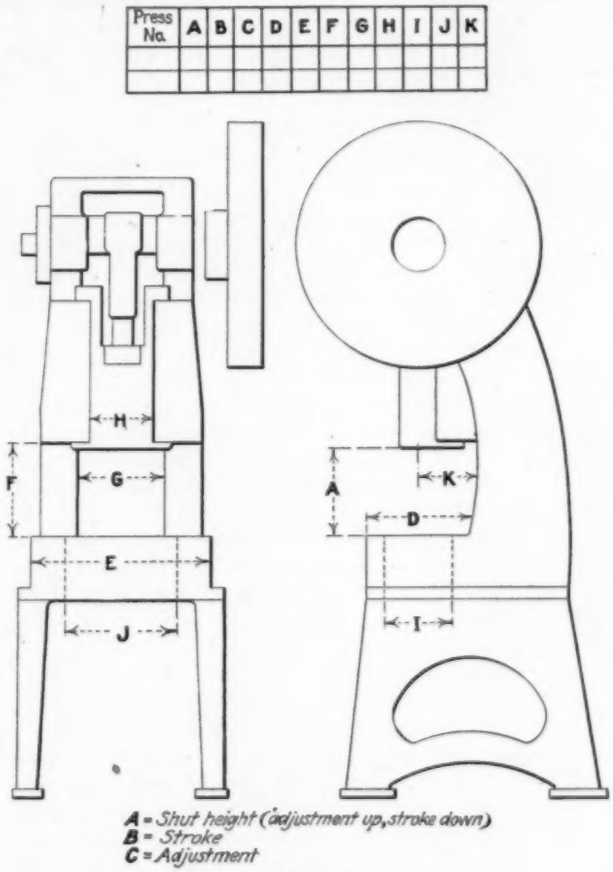


Fig. 20—A press chart

A hole is then drilled and reamed for a standard taper pin at *D*. When the pin is driven home, the piercing punch becomes a rigid unit with the main punch holder. For replacing a punch, all that is necessary to do is to drive out the pin *D*, remove the holder with the broken punch, replace the broken punch with a new one, and reverse the process.

The method of holding the die in the die plate and keeping it from rotating is shown in Fig. 18. The die is held in the same manner as the punch, by means of the half hole *C* and a corresponding half hole in the plate which receives a pin. It must be understood that in order for such punches and dies to be interchangeable, the half holes *D*, Fig. 17, or *C*, Fig. 18, must be accurately drilled or milled in the same location in all dies or punches of one size.

In addition to the standard parts that have been here enumerated there should be a chart for each press in the plant, as in Fig. 20. Whenever dies are to be designed, all the necessary information can be obtained without going near the press.

The most important dimensions are *A*, *B*, and *C*. Next in order comes *K*, while *I* and *J* tell the largest size blank that can be passed through the bed. All the other dimensions are not quite necessary, but it is well to have them on the sheet, since they might be of use at some future time.

History vs. Prognostication

BY ENTROPY

Estimating probable costs and finding out the actual costs are essential to the success of any manufacturing business, but of all the elements of such a business they are the least certain of any. In a great many places the two duties are performed by two entirely separate groups of men, jealous of each other and always ready to point out each other's errors. The only difference is that the cost keepers, being historians in a way, have the advantage of the last word, when they want it.

Why should not these men, who know what has happened be the best fitted to say what will happen? If past costs were plotted as a curve, future costs should be a prolongation of that curve, unless something radical happens in the meantime. The only radical things that should happen are those improvements that come from study of the past. Any other things are accidents, usually unfavorable.

DIFFERENCES OF OPINION

In some shops, and some of them big ones, this is done, and the cost department is an important part of the whole organization, in others the management considers it necessary to have a cost department but thinks of its members as "a lot of old women in trousers," pays no attention to its findings unless something comes up that demands its support, and in general uses its work so little that the department is almost an extravagance.

There is every reason why the cost department should be a vital part of every manufacturing establishment, not merely as keepers of the history of production, but as forecasters of what is to come. It should be possible to go back in the files and find out the results of every experiment that has been tried in the production department, regardless of whether the change was of the whole management, or merely a change from milling machine to planer for one job. Too often this information is present in the cost department but totally hidden because there is nothing there to indicate that a sudden rise in costs had to do with a change in the steel used, a change in foremanship, or the installation of a new and unsatisfactory machine. The job of the cost department seems to be to record, and to record only.

There is but one justification for keeping a record of the past, and that is to predict as far as possible the future. What has been done is water gone over the dam. Time spent and acts done cannot be recalled, but the experience gained is a great asset in facing the future. If there are any "old women" in the cost department get them out and get some live blood in, and make their job vital by adding the work of estimating to their present job.

Notes on the Use of Disk Grinders

By C. C. Hermann

THE disk grinder has an important place in industry and where proper regard is paid to dressing the disks, it works very efficiently. It is not uncommon to find users of disk grinders who do not understand that the disks can be dressed. Because the disks are thin when compared with the ordinary abrasive wheel, it is thought that the dresser will do more harm than good. In fact it will do considerable harm unless used by one who is experienced in its use.

First we must consider the grade and grain of the abrasive used in the disk construction. It is a good rule to adopt for a given piece or class of work, the coarsest grit possible and yet obtain the type of finish required. Right here is where a good many grinders are misled. Since sharp grit will cut much deeper than dull grit, a finer grit is often selected because the fresh disk produces such deep scratches. Permit me to point out, however, that this depth of cut is generally confined to the first few pieces ground. The grit wears down after a while, resulting in duller abrasive and, consequently, shallower scratches on the work. Quoting from experiments conducted by one of the larger manufacturers of abrasive disks: "No. 24 grain cuts 2½ times as far as No. 36 and 4½ times as fast as No. 46. The No. 24 disks cost only 23 per cent more than No. 46 disks."

From a test conducted by the writer, using No. 24 grain on a 22x6-in. disk in grinding spring steel, I found that the disk was capable of grinding 300 pieces wedge-shaped before it was worn so badly that it had to be removed. These pieces were 1½x¼-in. spring steel, ground to a wedge shape along the 1½-in. edge. I found that after the first 100 pieces, the work was retarded so that the operation was very slow. The disk would glaze over, necessitating some dressing to avoid heating the steel to a red heat during the grinding. The speed of the disk was 1,600 r.p.m., which was somewhat fast for this type of work. The average surface speed of the disk was 5,870 ft. per min., whereas 5,000 ft. per min. would have been about correct.

A disk of No. 16 grain was then used, with the result that the cutting was much faster. We were able to grind 400 of the same pieces of work without trouble from glazing. It appeared that should the average speed of the No. 24 disk be cut to say 5,000 ft. per min., much better results would have been obtained.

Importance of Speed

The speed at which the disks are operated is of great importance. The principal indication of improper speed is glazing. This condition is apparent from the reflection of light from the disk, and when it is in this condition it must be dressed. Glazing, then, is an indication of the speed being too high for the area of the surface being ground. On the other hand, should the disk wear fast, and full size grains be found in the dust, the speed is too low for the work being ground.

While variable speed of the spindle is desirable, it is not always possible. In the event of a constant spindle speed, then the speed should be such as will bring about most efficient operation. Of course, it is possible to obtain disks made to order, with regard to bond, and which will exactly suit the spindle speed of the machine. However, since this would involve higher prices and special manufacture, it should be avoided. For the general run of medium- and low-carbon steels, a spindle speed that will give the disk a peripheral speed of between 5,500 and 6,500 ft. per min. will be about correct, whereas for high-carbon steel, the speed may be slightly lower.

The proper speed of the disk depends somewhat upon the area of the work presented against it. For example, comparatively large work area will result in increased wear on the disk and also in increased glazing. This is because with the larger work, each grain of abrasive presented to it must remove a comparatively larger amount of metal than when grinding smaller parts. By increasing the disk speed, a greater number of grains will be placed at work for each unit of time, increasing the number of pieces ground per disk.

Small pieces of work act on the disk somewhat like a dresser, eliminating to some extent the use of the latter. Glazing is less prevalent with work of small area than with work of large area.

Effects of Vibration

Another factor which affects the disk condition and particularly its life, is vibration. End movement of the spindle is especially destructive to the disk and wherever end movement is prevalent, the disk generally wears very unevenly. With the ordinary grinding wheel, end play of the arbor does not make so much difference, but this condition brings about very bad results in disk grinding. The operator is unable to hold the work firmly against the disk, resulting in both it and the work pounding together at a high frequency. The grains are thereby dislodged from the bond, and at times we find the disk worn out entirely on one-half of its surface, and scarcely worn on the other half.

End play cannot be countenanced in disk grinding if even a moderate degree of efficiency is to be obtained. The work as well as the disk will tell the tale. The work will likely be anything but true and the operator, attempting in vain to produce reasonably good work, will be forced to use the dresser frequently.

Dressing the disk does no productive work. It does, however, correct a defect, such as unevenness or glazing. As soon as the disk glazes or becomes uneven, the dresser must be resorted to. Time is wasted and poor work turned out oftentimes because of insufficient use of the dresser. If the disk glazes, the only remedy is to dress it, but the dresser should be used sparingly.

To sharpen the cutting surface of the disk requires the removal of the dull grains of abrasive. These grains cannot be resharpened. Possibly a few grains are broken up and thereby sharp edges presented, but the greater percentage of the dull grains is literally knocked out of the bond by the action of the dresser, thereby presenting new and untouched grains to the surface. The longer the grains can be kept sharp by the use of proper speed and the elimination of mechanical defects in the machine, the longer the disk will turn out well finished work without the necessity of using the dresser.

While the Huntington type of dresser is generally used, it must be used much differently than on abrasive wheels. It should be held against the disk very lightly, the intention being to simply remove the duller grains. The necessity for removing high spots will generally occur in disk grinding only when the machine is defective or out of adjustment.

The Efficient Executive

How the shop executive has become a new element in industry—The many qualities necessary to success — How these traits may be developed

By William Davenport

ALONG with other prehistoric relics, the "white-collar job" has passed into the realm of yesterday. The necessities of modern industry have lifted the shop executive out of the rut into a position where he is no longer a mere driver, but a responsible leader. The rise of these industrial chiefs has been one of the outstanding incidents of the last quarter century. They live in comfortable homes, tastefully furnished; they send their children to college and they are more nearly their own masters than the old regime would dream of.

Back of this there is a good and substantial reason. The exigencies of the present demand that he shall give more to his employer, more to his worker and more to himself than his predecessor did. He must have a comparatively complete knowledge of three things—machinery, materials and men. What information he obtains concerning materials and machinery, he may acquire in whatever way seems most available to him. If the privileges of a technical school are open to him, well and good. If they are not then he must depend upon the long and tedious process of apprenticeship. Nevertheless, the requirements of our present industrial life demand that he should have more than that. He must have a knowledge of the human element—a delicate and variable factor that enters into the problems of production. In fact, he must be a combination of all the qualities and abilities that are essential to every trade and occupation.

He must have, like the artist, clear perception of perspective, of the perfect circle and the exact square.

As a technician he must know machinery, blueprints, and the use of the slide rule and micrometer.

Like a salesman, he must sell the job to the workers and instill in them the necessary morale.

He should possess the clear and sane judgment of a merchant in order to plan and execute orders.

The qualities of a financier, such as prudence, foresight, and ability to analyze a situation should be possessed by him.

Finally he must possess the characteristics of an organizer and an administrator in order to get good teamwork from his men.

Physical Requirements of Foremen

These qualifications are necessary so that he can direct the forces at his disposal in order to produce the greatest quantity at the lowest cost. His physical and mental ability and his habits of character all are foundations upon which the efficient executive must build.

A man who is physically handicapped is at a disadvantage as a shop leader. On the other hand, much of our ill health is our own fault and is due to indifference, carelessness or vicious habits of living. When Theodore Roosevelt was President of the United States, he appointed a Committee on the Conservation of National Resources. After an exhaustive study of facts and conditions, this committee included in their report the startling statements that, (1) The average man is only fifty per cent efficient. (2) We live out less than half the natural span of life. (3) One half of all human beings die before maturity or fall into the defective, delinquent or dependent classes. And the report continued to show that the larger part of all this sickness, misery and death was unnecessary. It is therefore true that any man with a normal physique may, by diligence and care, build it up into a healthy human body. Professor William James once said that the plain fact remains that men the world over possess a certain amount of resource, which only exceptional individuals use to the utmost. The path to good health is difficult only because we dislike to walk therein. If we are doing the duty which we owe ourselves, we will observe the proper laws of dieting and see that we get plenty of sleep. We will avoid the use of narcotics and partake in enough sports or gymnasium drill to keep our machinery in good running order.

Necessity for Mental Alertness

There was a day when for the shop executive, the emphasis was placed on the physical element, but we have come to realize that mental ability is as essential as the physical. Every day, almost every hour, the shop leader is called upon to see and grasp instantly, not only with his eyes but with his brain, the details of a machine, the accurate measurements of plan and blue print or the elements of a delicate shop situation. He must focus his attention upon methods of production including charts, reports, requisitions or materials and he must do it often amid distracting conditions. Unless he learns to shut out all other appeals to the eye and ear, except the one under consideration, he will either fail or seriously delay operations. More than this, he is confronted with conditions that call for reasoning and analysis. He must be a man with a trained mind and clear judgement.

While these requirements seem exacting they are, after all largely matters or habit and require only to get the will definitely back of each resolve and to keep constantly in mind the necessity of improvement.

Men working about a shop and among machines day after day if asked to describe in detail any particular machine, can do so usually in only a casual way. Few persons can draw a diagram of the house in which they live and locate each door and window. Most of us cannot even tell what sort of figures are on the dials of our watches. We see these things but they do not make any deep impression upon us.

Our trouble is that we lose much of our time lacking a definite idea or purpose of improvement. Riding or walking to work, if we definitely read the signs or look for the objects of interest along the way, we will be surprised to discover how many things we have missed. It will be a good plan to cut down the newspaper reading on the assurance that some of what we read there will be of no consequence; we might write out every night a list of all the new things and people we have seen during the day, look into a shop window for three minutes and jot down the objects that it contains, take any picture of a landscape or an interior, study it for a few minutes and then try to recall everything it portrays. When we check up ourselves we will be amazed to realize how faulty are our powers of observation. But it is good practice and if it is kept up it will become automatic in time, and it will be worth money to us.

The Value of Keen Observation

Recently a young man, after having this called to his attention, went through the factory the next morning with the purpose of observing. At once he noticed a defective part that had been made in that way for months. No one had observed it or thought how to correct it. He called it to the attention of the superintendent, and a way was found to perform the operation differently. The concern is saving hundreds of dollars as a result of the discovery.

If we find it difficult, amid the noises of the shop or the distraction of other duties, to fix our minds on a given problem, here again it is largely a question of practice. First of all, we must be conscious of the necessity of accomplishing the desired object, make a definite effort to realize its absolute importance. We should take this problem home with us and try writing a letter with the loud speaker going full blast. It requires little effort to read light fiction where the plot keeps the attention. But it will be a good plan to read articles that are not interesting and compel ourselves to read them whether we enjoy it or not. If we read a paragraph and do not get it the first time, read it again and again until we can master it. In a short time we will find that such concentration can be accomplished without effort.

Most of our failures are due to haste. We should be able to make decisions quickly if possible, but first we must make them correctly. The only way we can be certain that we are right is to leave no doubt that we have all the facts. Then learn to analyze them. Get the relation of each fact to every other fact in the problem. Study every possible implication and the effect of our decision and then make it. One of the best plans is to select some man in whose judgment we can have absolute confidence and whose decisions are regarded by others as being generally sound. Check our decisions against his on questions we have been considering. Analyze the points of difference and the weak points in our judgment when we do not agree.

There are certain other qualities, that for want of a better name we may call simply habits of character which depend largely upon a man's outlook on life and his attitude toward the world, his job and his employer. The duties and responsibilities of the shop executive are exacting. He must deal with all sorts and conditions of men. He must handle the swelled head, the chronic grouch, the discouraged, the physically unfit, the lazy, the practical joker, the jealous, the trouble breeder and some scores of other difficult workers. To do this successfully, he must possess tact, fairness, a sense of justice and the ability to inspire loyalty and team work. Unless he does, he can never expect to build up and hold together a group of efficient workers.

These qualities do not lend themselves easily to any definite and specific rules. They must be born out of our purposes and desires to think always of the rights of others. When tempted by a worker's stupidity, carelessness or stubbornness to "fly off the handle," it is a good idea to pause for just a moment and think what may be the result to the other man if we give him a "bawling out." That practice so common years ago has spoiled many a good man in the making. In settling differences between the men it is absolutely necessary to be just and fair. The shop is no place for prejudice, whether racial, religious or political.

All this may make it seem that the shop executive should be very nearly a perfect man, physically, mentally and morally and that it is possible for him to attain that high standard. This is not so far from the truth as it appears at first sight. He is the man who can make or mar a whole department of industry. He is the skilled technician, the leader of men, the one who fixes the standards and quality of production in all the great plants of our country. His problems are complex and therefore his abilities must be numerous and well developed. And they all combine into that one mysterious thing we call "personality."

Wanted, A Time-Saving Steel Rule —Discussion

By Wm. S. Rowell

Please let me correct the impression that may have been conveyed by Mr. D. A. Hampson in his article in Vol. 62, page 996 of the *American Machinist*.

I have more than one steel scale (rule) of more than one make that were made more than 25 years ago, that are equal in every way to similar rules made today.

The suggested graduations, 16ths and 32nds, are all right, but the regular graduations are near enough to answer. I am wondering if a good deal of the scale turning to which Mr. Hampson refers is not caused by a wish to use the arabic numerals in their regular order; that is, starting with 1?

Scales with hundredth graduations are made and bought wholly because we of the machine shop are forced to use two entirely different series of subdivisions of the inch, namely, the binary and the decimal. The latter is forced on us through the prevailing and very erroneous belief that the decimal subdivision lends itself more readily to accuracy. The fact that we acquired the micrometer, more or less directly, from a country using a decimally divided linear unit was, and always will be, a vast misfortune.

The difficulty of translating one system into the other at most points seems well nigh insurmountable to a great many machinists. The scales decimally subdivided, tables of decimal equivalents, etc., etc., are necessary.

Noting the measuring habits of different men of my acquaintance, some of whom are able to measure within 0.003 in. with a steel scale, it is apparent that while one may prefer the 32nd corner another may use the 64th, and some change from one to another, especially when the length falls between lines.

Modern Drafting Rooms

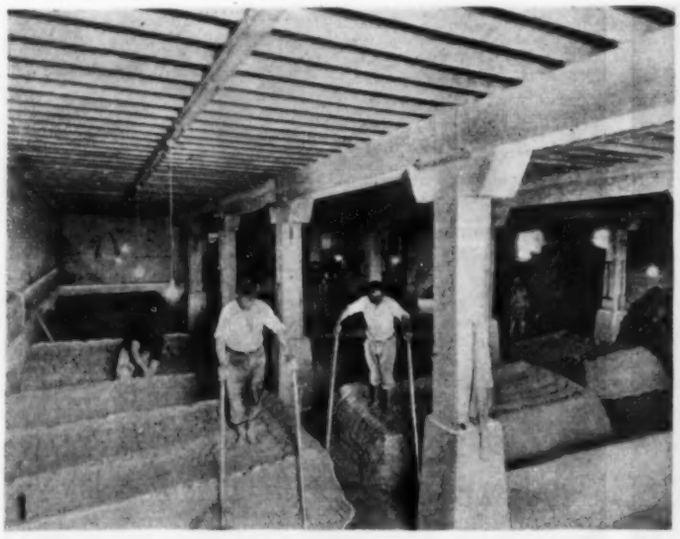
1—Cincinnati Planer Co.—200-watt lamps

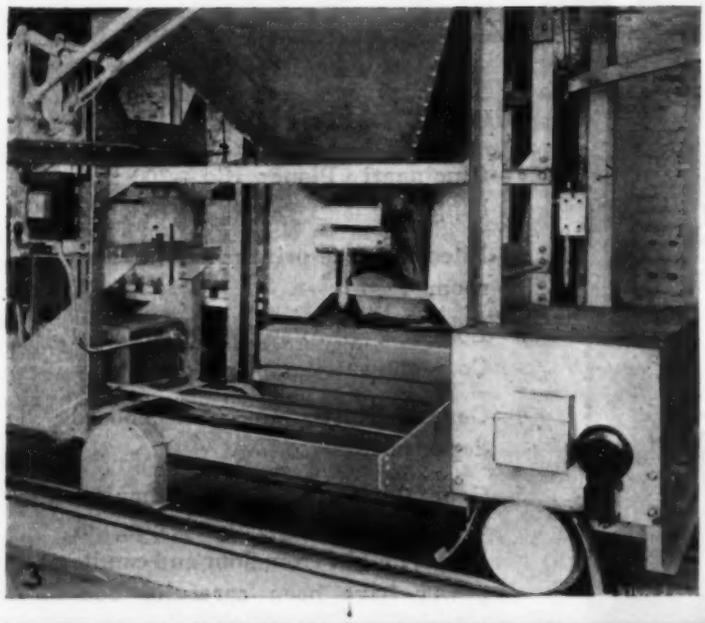
2—Files and blue print machine, same room

3—Lodge & Shipley Machine Tool Co.—200-watt lamps

4—General Electric Co.—switchboard department

5—General Electric Co.—mechanical design section. The spacing of lamps, height from floor and candle power have been carefully considered





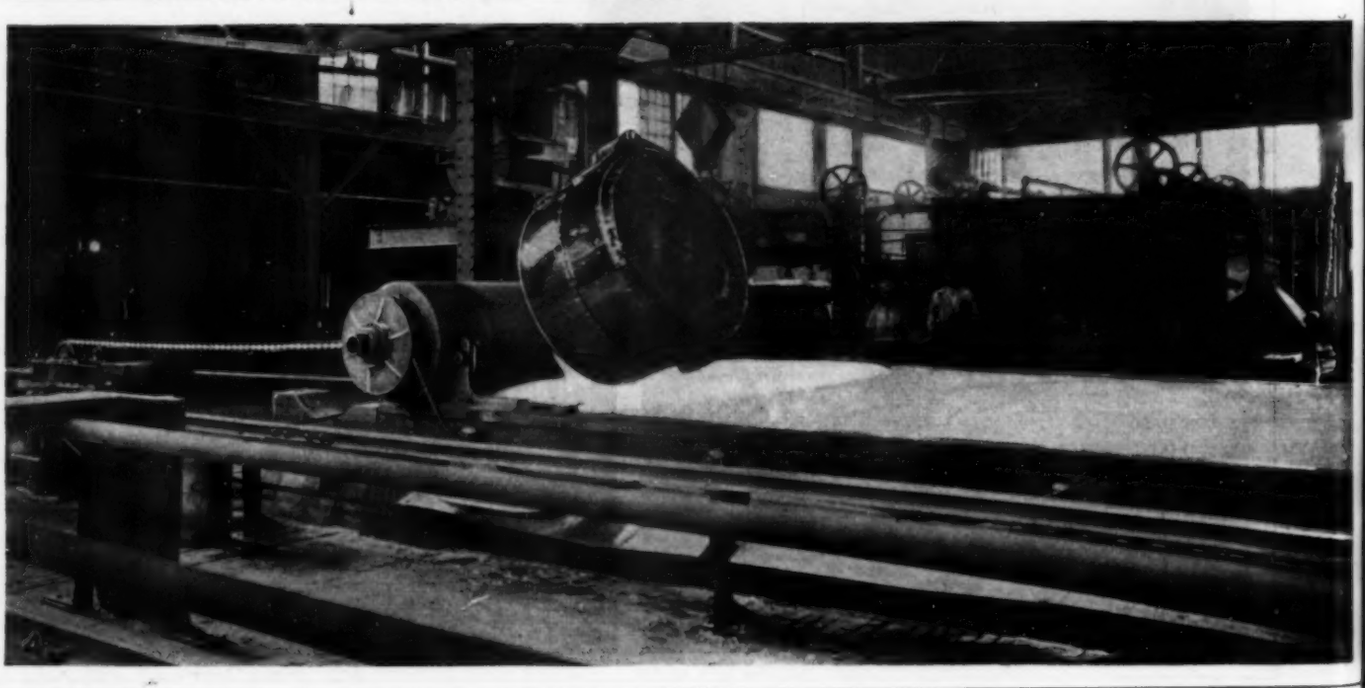
Making Plate Glass for For

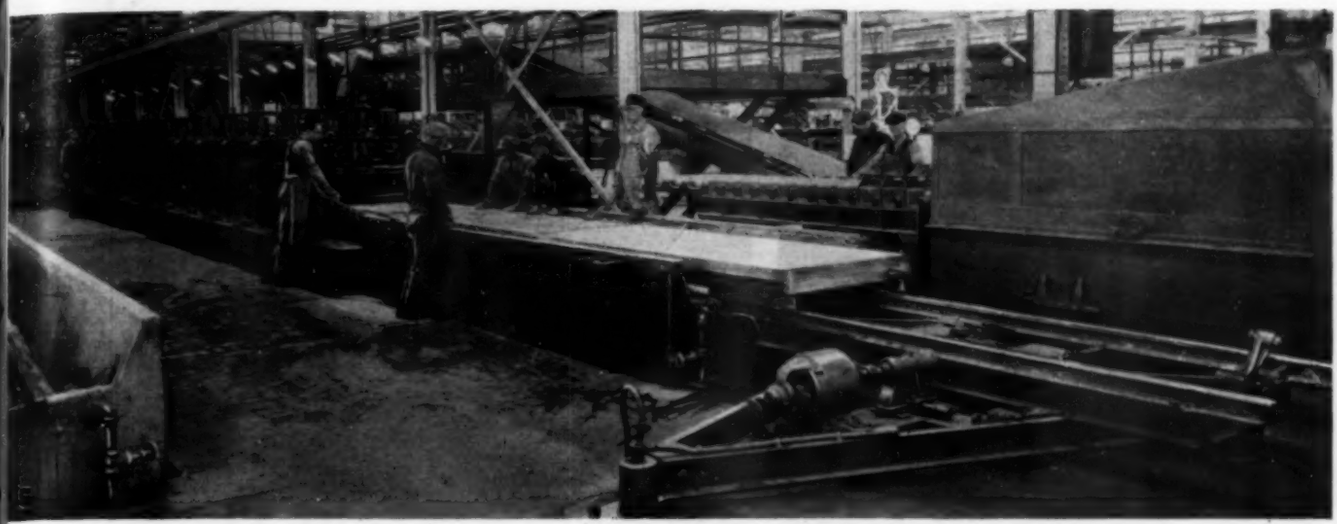
1—Kneading clay for the melting pots

2—Pots are made by hand by building up with clay

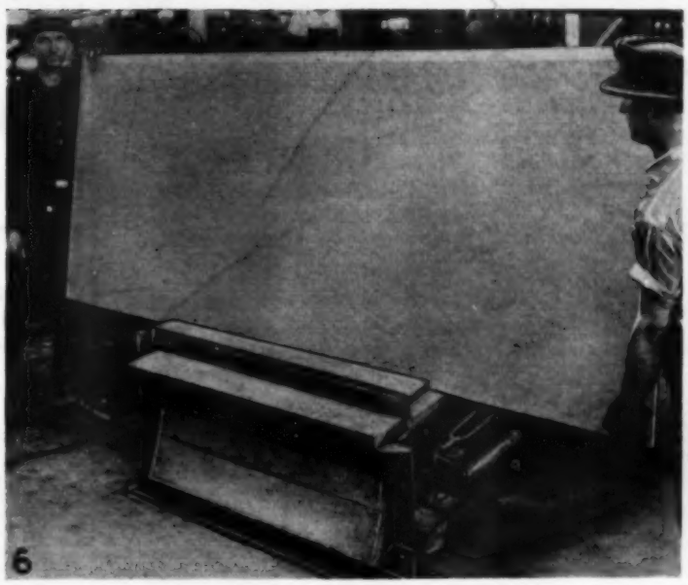
3—Automatic car that charges furnaces

Photographs by courtesy of the





or Ford and Lincoln Cars



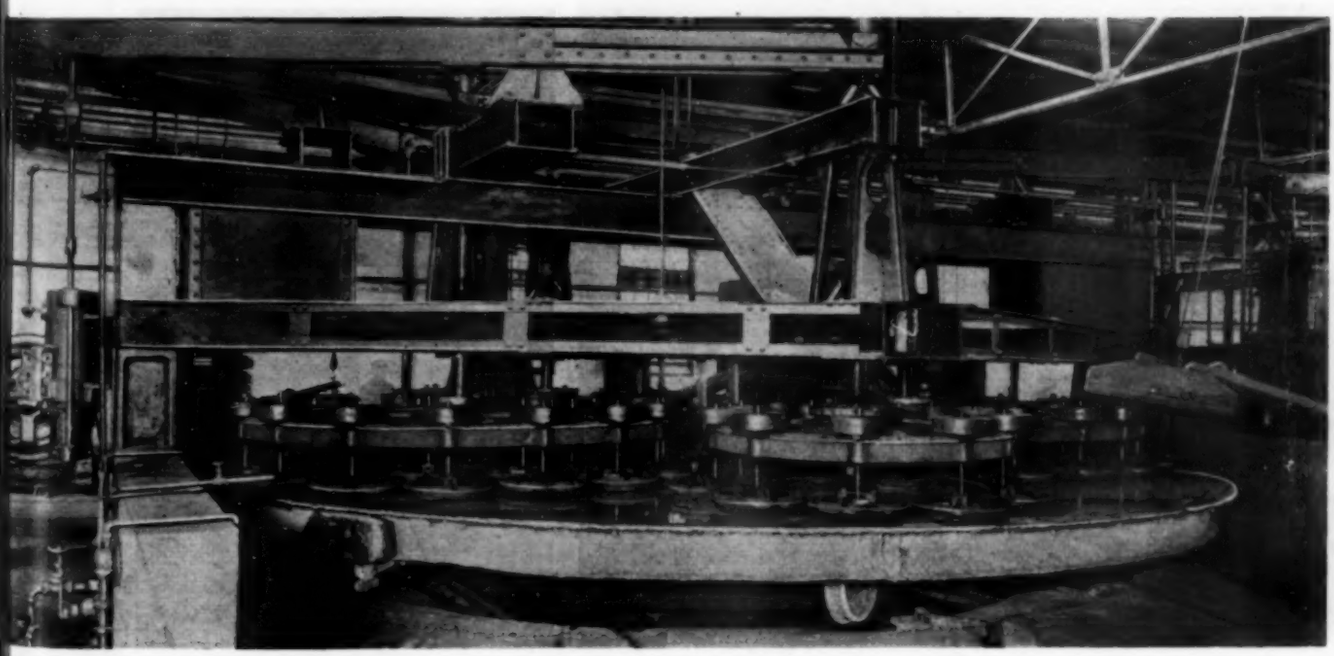
4—Casting glass on table

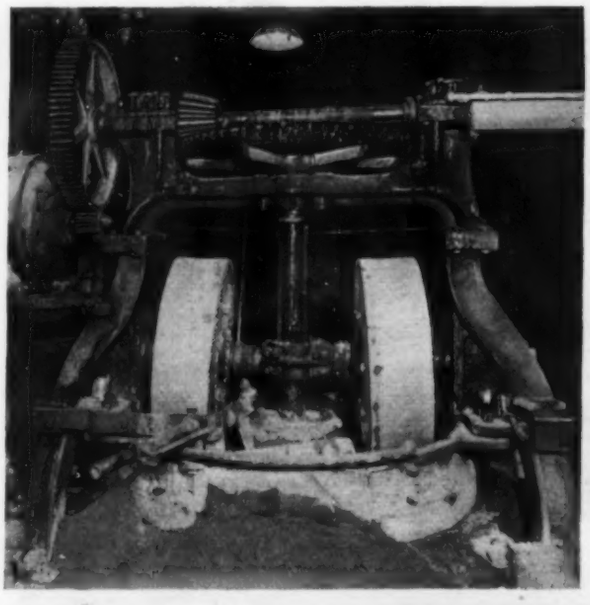
5—Continuous grinding of a long, glass sheet

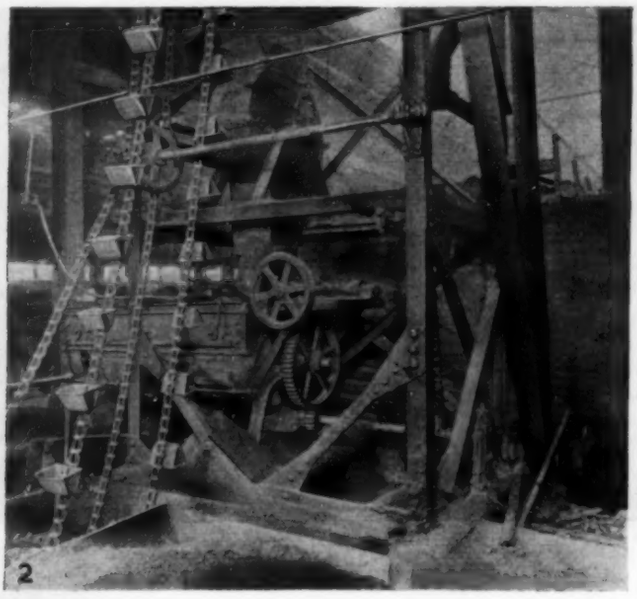
6—Sheet cut to size

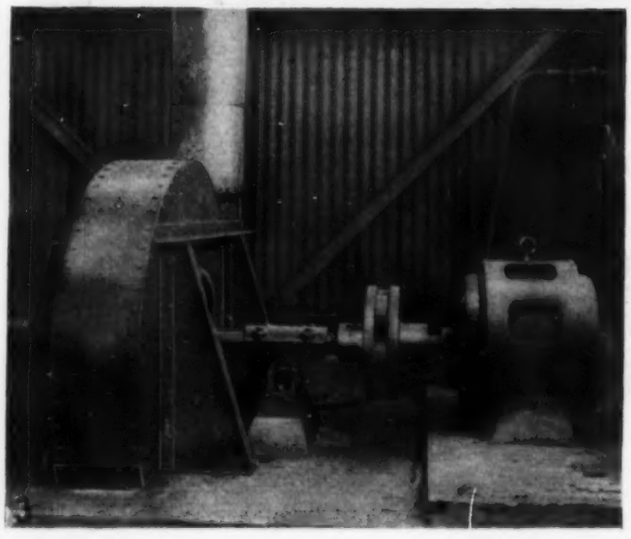
7—Where the final polish is given lamps

of the Ford Motor Co.









Motorized Machines in Many Industries

1—Facing mill in steel foundry

2—Sand elevator in foundry

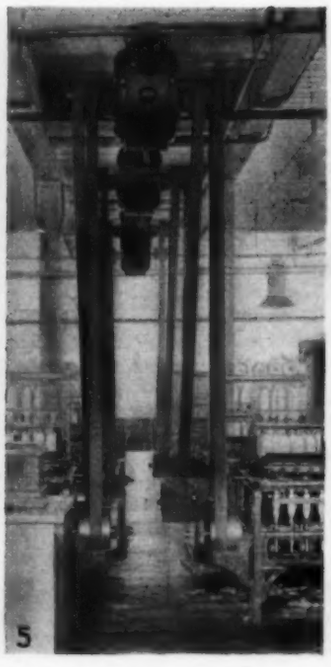
3—Direct-driven blower

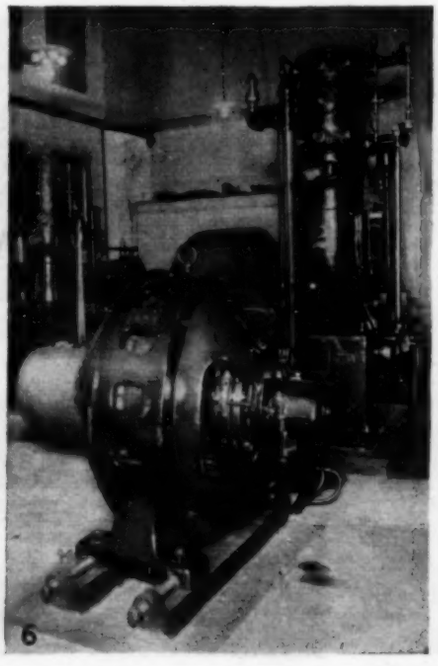
4—Vertical pump

5—Cotton-spinning frames

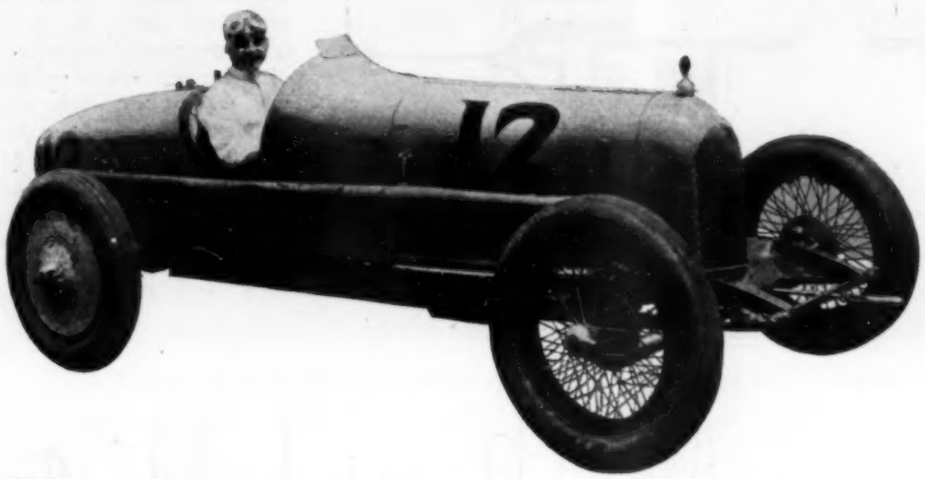
6—Water-pumping station

Photographs by courtesy of the Lincoln Electric Co.





Automotive Production



Building Racing Cars

By John Younger
Associate Editor
American Machinist

An Interview with Fred Duesenberg

IT MIGHT be luck that enables a car to win one race, but when a series of races are won there is usually found to be some underlying fundamental reason why success comes as a matter of course to one car.

Last year a Duesenberg car won the Indianapolis 500-mile classic. This year the feat was repeated and two similar cars also came in the "money." In addition the Altoona race which, if anything, is more severe, also was won by the same car. In the race at the Laurel, Maryland, track on July 11th it averaged 123 miles per hour to win. The world's record for automobile speed—139.7 miles per hour—is held by a Duesenberg.

The Indianapolis race is a severe test for a car. The 500 miles were covered at an average speed of over 101 m.p.h., and it should be noted that at this speed every imperfection of the track is magnified so the journey is not like traveling at 25 m.p.h. along a smooth boulevard, but is more nearly comparable to traveling at 40 or 50 m.p.h. over a rough, bumpy road. The spring suspension of a racing car has to be especially designed for this extreme service.

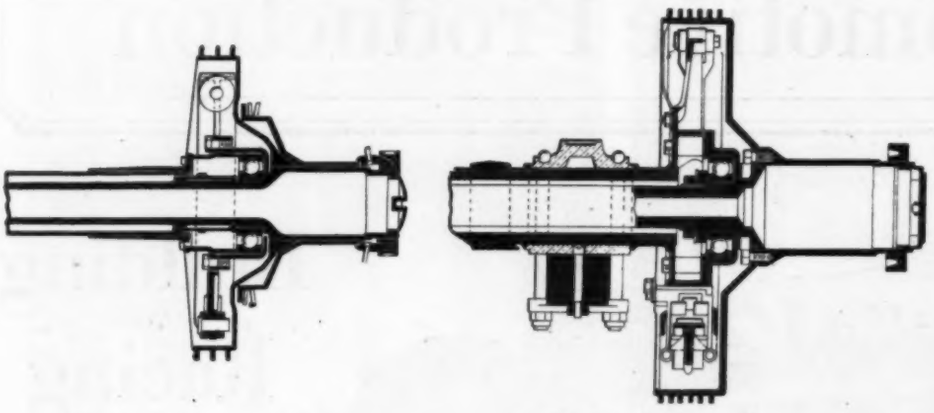
Fred Duesenberg

Three elements enter into the success of a racing car. Workmanship, design and the driver are these three factors and Mr. Duesenberg places them as equally vital, although naturally the driver comes in for special prominence because of the supreme effort he makes.

Racing cars are built by craftsmen. A few specially picked "super-toolmakers" build the Duesenberg racing fleet, and very high workmanship is the rule. The machine tools used are of standard type, the operations being simply usual ones carried out to a great degree of refinement. Low weight per horsepower is vital and therefore the complete chassis with racing body weighs only 1,435 lb. with the engine developing 140 hp. at 5,000 r.p.m. This means that the factor of safety, although still retained, has to be pared down to the absolute minimum and the factor of ignorance eliminated. Each individual piece is most carefully scrutinized and metal removed from it by turning, milling or boring. The steels used are high-tensile alloy steels and they are first machined all over, then heat treated and when necessary finished by grinding. If no grinding is done the machining is finished to leave a smooth surface, as corrugations, tool cuts or scores lower the factor of safety. Usually such surfaces are finished by a carborundum polishing operation. Fred Duesenberg and his brother, August, who helps him build the racing cars, personally inspect each finished piece, determining first if it is safe and second if it is light enough.

Contrary to common belief, racing cars are not built anew each year, but are rather a product of evolution. Today's car has many parts in it that functioned in last year's successful racer. The car is repeatedly tested out on the race track, then taken apart and each individual unit examined for wear or flaw and then returned or replaced as the case may be. Instinct and

AUTOMOTIVE PRODUCTION



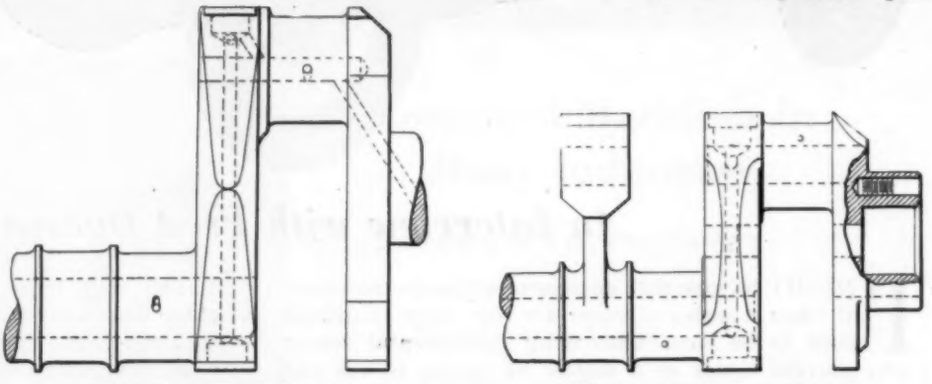
(Left) Stock car axle at wire wheel hub

(Right) Racing axle at wire wheel hub

intuition based on years of experience guide Mr. Duesenberg and his craftsmen in their decision. These picked men have been together for many years.

The method of joining that has been found very successful is a soldering or sweating process in which ordinary 50-50 solder plays an important part. Joints, of course, can easily be the weak points in any structure, particularly where light weight is desired, so in this case precautions have to be taken to get junctions effected with maximum security. A system of tapered wedge surfaces mated together is used. These surfaces are tinned and then heated to a moderate temperature and the solder introduced to sweat the surfaces together. This process has the advantage of requiring less heat than welding or brazing and consequently does not affect the heat treatment of the parts thus allowing the high elastic limit to remain unimpaired and preventing warping, a consideration of great importance in racing cars.

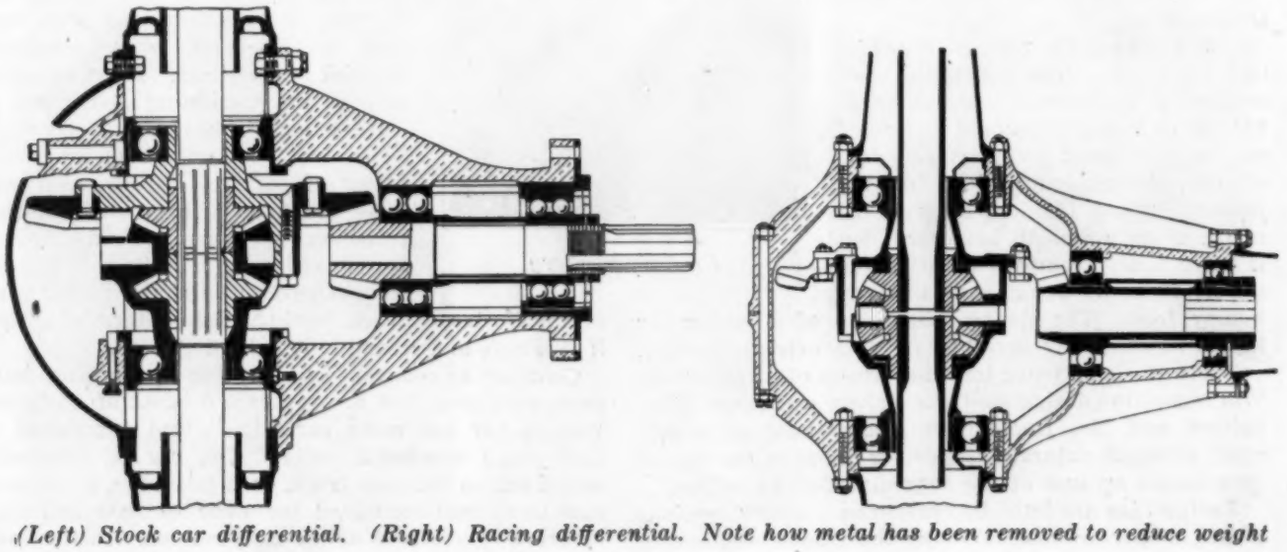
To return for a moment to the subject of weight, the average car costs the purchaser about 35 to 50 cents per pound of weight. Mr. Duesenberg considers low weight of such vital importance that he does not hesitate to spend $10 to save a pound in weight and in such vital parts as connecting rods, valves and pistons, weight plays such an important part that the cost might be reckoned as $10 per ounce of weight saving.



(Left) Stock crankshaft

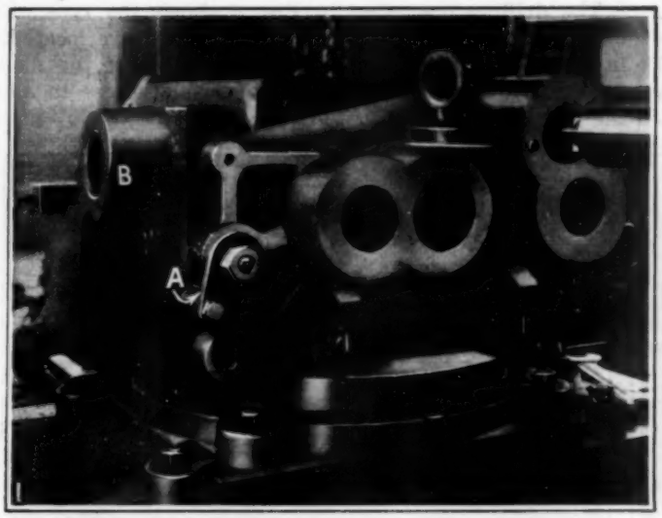
(Right) Racing crankshaft

Mr. Duesenberg emphasizes the evolutionary process requisite to develop a racing car. Build, try, disassemble, scrutinize, rebuild, try again and so on—an infinite repetition. The racing car is in fact a product of genius based on an infinite capacity for taking pains in putting the parts together and in design. "Out of the crucible of racing has come commercial perfection."



(Left) Stock car differential. (Right) Racing differential. Note how metal has been removed to reduce weight

AUTOMOTIVE PRODUCTION



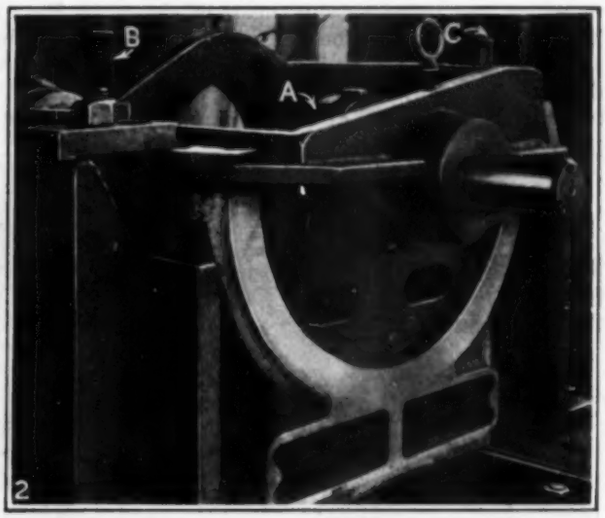


Fig. 1—Boring fixture for pump case. Fig. 2—Another boring fixture for central portion

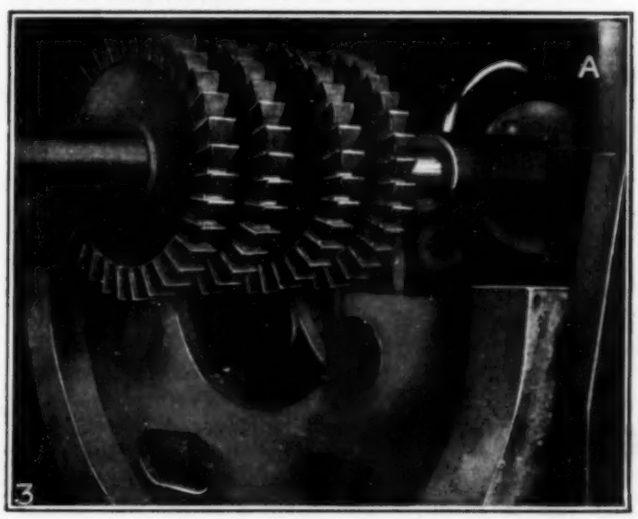
Fixtures for Diesel-Engine Pump Cases

By Fred H. Colvin
Editor, *American Machinist*

Types of fixtures and boring tools used in machining pump cases for use with Diesel engines, showing how large work is handled in fair quantities

ONE of the Diesel engine units that requires considerable machining is the pump case in which the fuel injection pump as well as the governing and air starting mechanism are housed. The illustration will show how completely the operations are standardized, also the extensive use of fixtures. The methods shown are made possible by the intensive manufacture of the units by Fairbanks, Morse & Co., at their plant in Beloit, Wisconsin.

One of the boring operations, as well as the fixture



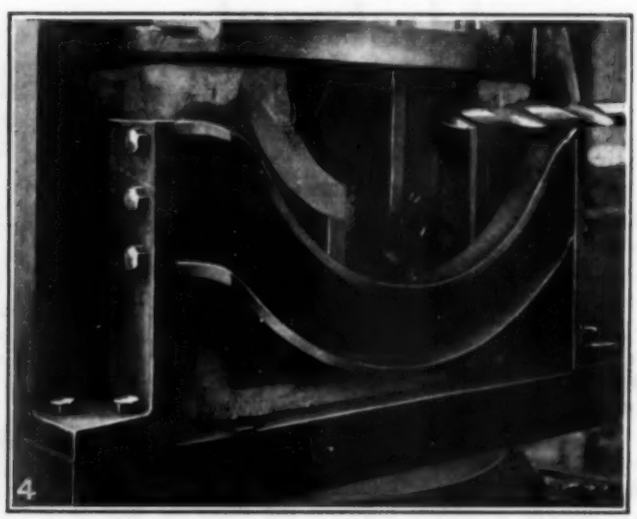


Fig. 3—Straddle-milling bosses. Fig. 4—One of the drilling fixtures

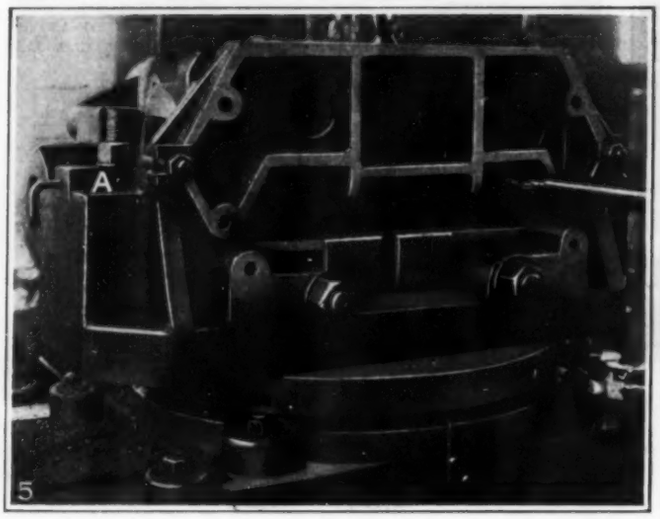
AUTOMOTIVE PRODUCTION

in which the pump case is held, is shown in Fig. 1. The fixture is mounted on a circular base that is graduated and provided with index points. The substantial design of the boring-bar guide, as well as the use of a swinging open washer at *A*, is clearly shown. As indicated by the bushing at *B*, the fixture is swung 90 deg. for a certain operation.

Another boring operation that also includes the use of fixtures, is shown in Fig. 2. Here again the boring bars are supported and guided in substantial bushings and the size of the cutter head is shown at *A*. Plugs *B* and *C* help position the pump casing in the fixture.

A milling operation, that of facing both sides of the bosses on the two walls of the pump case, is shown in Fig. 3. Two pair of straddle mills are used and both ends of the bosses are finished at the same setting. The plug *A* is used in locating the top case in the fixture.

The drilling operation in Fig. 4 shows the type of fixture used for this work. The bushings are located in the T-shaped casting shown, the frame of the fixture being downwardly curved to permit access to all the holes.



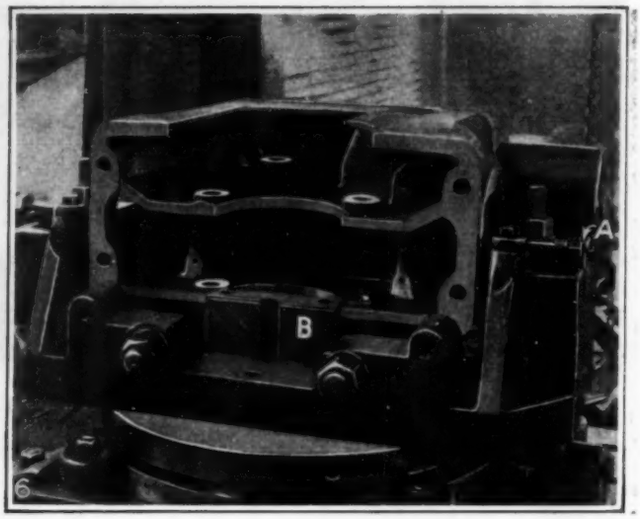


Fig. 5—Another drilling fixture with bushing plate in place. Fig. 6—Same fixture with bushing plate removed.

Another drilling operation is illustrated in Fig. 5, while Fig. 6 shows the same fixture with the front bushing-plate removed. It also shows the swinging bolts at each end by which the bushing plate is held in position, and the use of a sliding clamping strap that is provided with a handle, as at *A* in both figures. Fig. 6 shows how the central bore of the pump case is located against the projection *B*, and also gives an idea of the number of holes that are drilled in the pump case at this setting.

The building of Diesel engines on a scale sufficient to warrant the use of fixtures to such an extent, is a good indication of the use of this type of prime mover.

Abstracts

from other publications

Elimination of Waste

Harvey S. Firestone, president of the Firestone Tire & Rubber Co. discusses several methods for waste elimination that have proved successful in his plant. One of the most important is for the officers to receive suggestions from their foremen—suggestions come in freely, some of the ideas are good, while others are not so good. The ideas are carefully culled over and scrutinized by Mr. Firestone, himself, who chooses the ones to be incorporated in the plans of the company.

Another method for cutting down waste is to have the actual waste per operator marked off on a blackboard along with the operator's name. This procedure encourages a contest between the different men to see who can lower his record most rapidly.

Many of the suggestions are for improvement in shop practice such as increasing the capacity of some machine. One particular suggestion adopted was for the electro-galvanizing of steel rims, and the new method not only put on a better coat but also doubled the output of the galvanizing department.

Another important factor in waste elimination is the breaking in of a new man. He is put under the care of the best workman in his department, and since this workman is on piece work he is naturally unable to turn out as many tires in a day as usual. While he is busy teaching the apprentice arrangements are made to have him paid on a different basis, so that while serving as instructor he actually earns more money.

The normal working week is 45 hours but in a temporary lull a cut to 40 hours a week is resorted to, thus avoiding laying off a single employee. The 45-hour week may be resumed when business increases and, if a special rush comes, a 50-hour week may be scheduled just as readily. This gives a 25-per cent leeway in production.—*Factory*, July, p. 35.

Book Reviews

Principles of Machine Design. By C. A. Norman, professor of machine design, Ohio State University. Seven hundred ten pages, 5¾x9 in., cloth board covers, published by the MacMillan Co., New York City. Price $6.50.

This book presents the subject of machine design as practised today and draws its examples largely from current practice. For example, in the chapter dealing with bearings, plain, ball and roller, the present practices in the automotive industry are described and many diagrams are given of current methods of design. The early portion of the book is devoted to the consideration of materials and the use of alloy steels. Their heat-treatment and the results derived therefrom are given in fair detail. The subsequent chapters deal with the conventional methods of joining materials both by riveting and welding. The examples of welding practice are based on the acetylene-flame method, the electric-arc methods and the thermit system. Considerable space is also given to the proper use of bolts, nuts and screws.

One of the most interesting and valuable sections of the book is that devoted to the study of gearing. Spur, helical, bevel, worm and spiral gears all come in for study and examples of their use are detailed as well as the problems involved. Two chapters that will be found of value are those devoted to clutches and brakes. Not only are automotive clutches considered but line-shafting clutches and machine clutches in general are taken up. The chapter on brakes deals with varieties for all kinds of industrial applications. The book is well illustrated, there being 600 illustrations throughout in addition to over 100 tables of various factors.

Health Maintenance in Industry. By J. D. Hatchett. Four hundred eighty-eight pages, 5¾x8¼ in. Cloth board covers. Published by the A. W. Shaw Co., Chicago, Ill. Price $5.

The author is a consultant on labor relations, and also lecturer on Labor and Employment Management at New York University. The theme of the book is that increased production cannot be expected from workers unless some attention is paid to their physical environment and needs.

This underlying doctrine is worked out in great detail but with few illustrations. The tabular information is particularly good, ranging through statistics dealing with longevity in various occupations, losses due to ill health, poisonous industries, eye strain, and lunch room equipment, to such detail as the amount of drinking water per person, sedentary or otherwise.

One chapter deals with fatigue removal, rest periods and seating, it being pointed out that of all aids to production, seating has received the least attention. The principles that should be embodied in a properly designed seat are given as well as considerable discussion on the matter. In the reviewer's opinion this chapter might have presented some illustrations of what satisfactory chairs are like.

About one third of the book deals with laundry facilities, sanitary standards, lockers and locker rooms, food and lunch rooms, heating and ventilation. The balance is given up to a study of the cause and the prevention of industrial accidents and diseases. The author's conclusions are that no further great returns can be expected in increased production from improved machinery, but that health maintenance offers an unmined field whose possibilities have, as yet, scarcely been realized. The introduction and successful operation of medical, hygienic, and sanitation work is no more difficult than the creation of any other new development, and similar principles should be employed in each case. Less than one per cent of all American plants have adequate medical service though emergencies are, as a rule, well provided for.

Chemistry of Engineering Materials. By Robert B. Leighou, M. S., Prof. of chemistry, Carnegie Inst. of Tech., Pittsburgh. Second edition. Five hundred thirty-eight pages, 6x9 in. Illustrated. Published by McGraw-Hill Book Co., Inc., New York. Price $4.

The revision of Prof. Leighou's book, the first edition of which appeared in 1917, consists principally of the rewriting and enlargement of the chapters on fuels, iron and steel, corrosion, non-ferrous metals and non-ferrous alloys. Omission of the bibliographies at the ends of the chapters was decided upon by reason of the difficulty encountered in bringing and keeping them up-to-date. Other revisions and additions serve to make the book more useful as a text book than at its first appearance. Its use as a reference book is hardly indicated unless only the most elementary information is desired. It is intended as a text and should serve this purpose very well. The subject matter is too extended, however, to make it very valuable for the other purpose.

Beginning with the treatment of water for steam generation the author takes up in order: fuels, refractory materials, non-ferrous metals and alloys, iron and steel, corrosion, foundry sands, building materials, paints, lubricants, glue, rubber, insulating materials and primary and secondary electric cells.

The treatment of each material consists of a brief statement of the manufacture or preparation, something of the chemical composition and properties and then a discussion of the physical characteristics and uses. Proofreading leaves something to be desired but seems to be somewhat better than the average.

Automobile Engineers' Handbook. By Richard Bussien. Eleventh edition of Automobiltechnisches Handbuch. One thousand, one hundred and six pages, 5½x8 in. cloth boards. Published by M. Krayn, Genthiner Strasse 39, Berlin W. 10, Germany.

The 1925 edition of the handbook is a large but compactly bound collection of much valuable material on automotive engineering and design. A few photographs and an abundance of line drawings, sketches and tables are used to illustrate and clarify the text.

The work is divided into parts to cover the different phases of the industry and further grouped according to smaller details in an orderly and systematic fashion.

Part I is devoted to a full discussion of the properties of a large number of metals and alloys, and many chapters take up the chemistry of fuel oils and a study of the petroleum products. The engineering part of the section studies the design of small automotive accessories, and of springs, gears, screw threads, chains, roller and ball bearings and other small parts.

Part II opens the consideration of such construction details as rear axles, four-wheel brakes, steering connections, transmissions, and in each instance many different types are represented.

In Part III, nearly all of the phases of the motor are taken up, including electric and steam drives, and radial gasolene motors.

The remainder of the book deals with electrical devices and wiring systems, and specialties in the automotive field. Types of truck bodies, motorcycles, motor boats, tractors and electric cars are included in this division of the book.

American Red Cross Abridged Text Book on First Aid.—By Col. Charles Lynch and Lt. Col. M. J. Shields, United States Army. Third revised edition, prepared for the American Red Cross. Two hundred fifty-six pages, 5¼x7½ in. Published by P. Blakiston's Son & Co., 1012 Walnut Street, Philadelphia. Price 60c.

This manual is the industrial edition, revised in accordance with the lessons of the world war and contains practical experience for teaching first aid to the injured. There are twelve lessons, including application of bandages, fractures, bleeding, burns, suffocation, unconsciousness, industrial accidents and other divisions of first aid, that will be found valuable for assisting and teaching persons connected in first aid work. The useful information given will enable anyone to apply the practical methods of aid to the injured, and is applicable for use in first-aid departments of industrial plants. Sixty-seven illustrations showing various methods for aiding the injured are included.

Illustrated Technical Dictionaries. Vol. XIV, dealing with the textile raw materials. Edited by Alfred Schlomann. Five hundred pages, 6½x9 in., board covers. Published by Brentano's, Fifth Ave. and 27th St., New York, N. Y. Price $6.

This is the first volume of a series of dictionaries that will embrace the entire field of textile engineering and processes. It contains 10,000 stock-phrases in six languages—German, English French, Russian, Italian and Spanish, and is illustrated with 434 line cuts. The alphabetical index has been arranged according to the different languages. The volume should be an aid for forming an intellectual link between the various industrial countries. The former volumes of the Illustrated Technical Dictionaries, covering various subjects, are being used to an ever-increasing extent all over the world, and this book should likewise be of exceptional value to the textile concerns that deal with the foreign countries.

F. B. I. Year Book & Register of British Manufactures. Six hundred twenty-six pages, 7x9½ in., board covers. Published by the Federation of British Industries, London, England.

As the title implies, this book is a directory of British manufactures and manufacturers, and is similar in scope to the trade and commercial directories so well known in this country.

The arrangement of the book is rather peculiar, in that the first 258 pages contain only the names of articles and their makers, but no addresses. Firm names and addresses are contained in the following 130 pages. The book is not indexed, the various articles of manufacture being arranged in alphabetical order throughout, with the names of the producers below.

The last 238 pages are devoted to advertisements of the firms listed in the book. The advertisements are all indexed.

Annual Report of the Board of Regents of the Smithsonian Institution, for the year ending June 30, 1923. Five hundred seventy-eight pages, 5½x8 inches. Illustrated. Published by the Government Printing Office, Washington, D. C.

The most recent report of the Smithsonian Institution contains the usual formal reports of the various activities of the Institution. In addition to ten appendices devoted to the respective divisions there is a general appendix containing nearly thirty papers and addresses on various scientific subjects. The only ones of any interest to the mechanical industries are those devoted to the production and use of ductile tantalum, the utilization of volcanic steam in Italy and a proposal for a tidal hydro-electrical power development of two rivers in the Canadian Maritime Provinces.

Release of Internal Stress in Brass Tubing. Bureau of Standards, technological paper, No. 285. Pages 235 to 265 of volume 19. By Robert J. Anderson and Everett G. Fahlman. Thirty pages, 7x10 in. Published by the Bureau of Standards, Washington, D. C. Price 15c.

The authors experimented with brass tubing of the composition 66.33; 33.17; 0.5, copper-zinc-lead, in order to determine whether heating at a low temperature would release the internal stress without lessening its hardness and strength.

The paper reports the success of tests under which the brass was placed. Heating at a temperature of 325 deg. C. for two or three hours effectively released the internal stress and still preserved the hardness of the brass. The authors describe the experiments and the use that has been made of the method.

The experiments were suggested by a user of tubes who experienced difficulty in certain manufacturing processes owing to the warping of the tubes on maturing over a period of time at room temperature and the methods that were developed by the experiments were applied.

Illustrated Technical Dictionaries. Vol. XV, dealing with spinning, its processes and products. Edited by Alfred Schlomann. Nine hundred and fifty-one pages, 6½x9 in., board covers. Published by Brentano's, Fifth Ave. and 27th St., New York, N. Y. Price $6.

The contents of this volume are alphabetically separated according to the six languages that are covered, namely English, German, French, Russian, Italian and Spanish. The terms and parts used in the textile industry, including spinning, winding, counting and testing, are shown with the aid of over 1,200 illustrations and many formulas. The dictionaries, in which hundreds of co-operators have been participating for over 21 years, are the only ones available to international engineering, science, commerce and industry. The technical terms contained may be telegraphed by a simple table that has been added to the Marconi-International Code, resulting in an enormous saving to those carrying on international communications.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Salvaging Obsolete Parts

BY C. E. BLIVEN

Our Stores Department reported 143 special-alloy links, shown in Fig. 1 as being obsolete, due to change in design. The links were made of ¾-in. round stock and welded at the point marked X.

This material represented an investment entirely too great to put into scrap at a value of around 8c. a pound, except as a last resort. Many and varied suggestions were made of methods to rework the links to the changed dimensions. All of them called for equipment we did not have, or for methods that were judged impracticable. The logical method seemed to be to stretch the links somehow. Our blacksmith finally developed the simple device shown in Fig. 2 with which he did the work. He first cut a hole slightly larger than the opening in the link, in a 2-in. steel plate used as a bench. Then he made the two end pieces with the proper curvature for the large and small ends. The inner surfaces of these blocks were flat, as shown. When in place in the link there was about ¾-in. space between the blocks. Narrow strips were welded to the blocks to take the wear and pins projecting from the sides of the blocks prevented their being pulled through by the wedge. The wedge was made of 2-in. hex stock with the edge thin enough to allow it to have a full bearing on the blocks at the start.

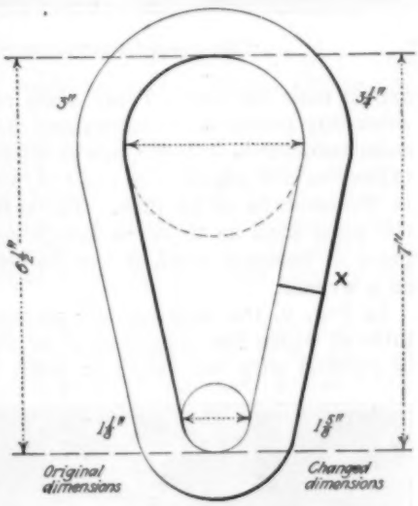


Fig. 1—The links to be stretched

The links were heated in a gas furnace, placed over the opening in the bench, the blocks dropped into place, the wedge started, as indicated by Fig. 3, and the helper with his sledge finished the job. After a few trials the wedge was marked to indicate when the links had been stretched to the required dimensions. These trials also developed the fact that the links would break where they had been welded when made. The blacksmith overcame this trouble by localized cooling at the welds.

More than two-thirds of the links were stretched without any particular difficulty. The remainder cracked or broke at the weld. These were rewelded with a torch, and all but three of the original 143 were returned to the store room for issue in accordance with the revised drawing. The cost of rigging up for the job was less than $5. The labor cost for the blacksmith and his helper was less than 19c. per link. The cost of the welding for the cracked and broken links was less than 10c. each. The total labor cost was under $35. So that our saving amounted to a substantial sum. The man who solved the problem has been recommended for substantial recognition by the management.

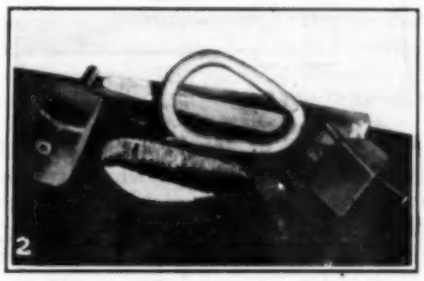


Fig. 2—Tools for stretching links. *Fig. 3—How the work was done*

The key to the whole problem was the cooling at the welds before attempting to stretch the links.

A Simple Planer Accessory—Discussion

BY C. G. WILLIAMS

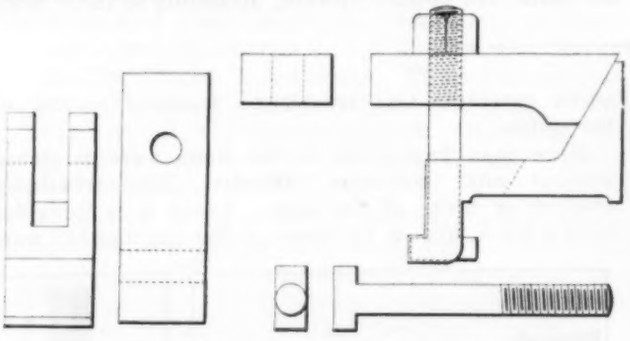
On page 749, Vol. 60, of the *American Machinist* in an article under the title given above, F. J. Wilhelm shows a sketch of a screw-post, or planer stop, that he considers very effective; while on pages 854, Vol. 61, and 359, Vol. 62, T. Heaton and H. Beard, respectively, come forward with a similar device which each believes to be an improvement over the others.

In years past it was one of the many foibles of the old-time machinist to make such tools for himself, and few there were of the traveling, or "boomer" type of journeyman who—though they might consider a pair each of home-made inside and outside calipers, a monkey-wrench, hammer, two chisels and a 2-ft. rule sufficient to fill out the complement of a well-stocked kit—could not produce from some crevice of the latter, a set of "planer-stops," "hold-fasts" or whatever name they might apply to them.

IDEAS FROM PRACTICAL MEN

It has been my privilege to use all three of the devices mentioned in the first paragraph of this letter, and, like the old-timer, I have found an adaptation—an improvement if you will—which I am here submitting, that I believe to be more suitable as an all-round tool to be applied to a wide variety of work.

From the sketch herewith it will be seen that my stop takes the place of the screw-stop, and that it also functions in place of the "point," or "finger," that the old-time machinists found so reliable, but which few of the younger generation seem to appreciate.



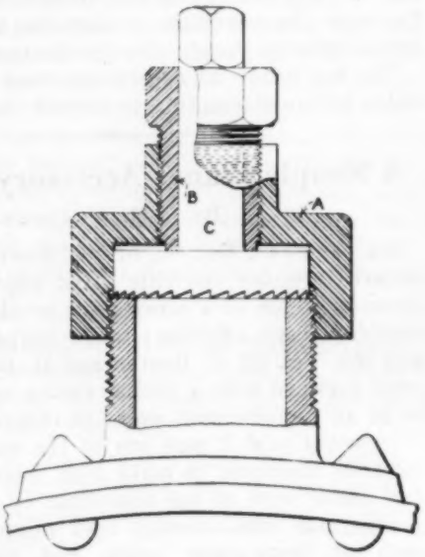
Planer stop and clamp

The "bar," "finger," or "point," of this stop not only crowds in toward the work, but it also forces it down upon the table. Such is its "pulling-down" power that it is almost impossible to move work held by it.

Tool for Refacing Seats of Washout Plugs

By H. O. Turnbull

Since the washout plugs on locomotives are riveted to the boilers, refacing the seats must be done in place, and the tool shown in the illustration was made for the purpose. The steel cap *A* is threaded to fit the plug and is provided with the threaded bushing *B* at the top. The shank of the facing tool *C* is a slip fit in the bushing *B*. With the device assembled as shown, the cap *A* is screwed on the washout plug and the bushing screwed down until the cutter bites into the top of the plug. The seat is then refaced by turning the cutter by a wrench applied to the square on the end of the shank. Further cutting can be done by screwing down the bushing *B*.



Refacing tool for washout plugs

Adjustable Parallels

By W. E. Buck

The parallels illustrated herewith are made so they can be adjusted to level the work in the milling machine or shaper when the table is more or less out of alignment. They can also be used for work having a slight degree of taper.

As will be seen in Fig. 1, the parallels are split through the center, the split terminating in a hole drilled near one end. Taper holes running lengthwise, extending nearly to the center and tapped at their inner ends, accommodate large screws with tapered heads for expanding the parallels at one end, and may be adjusted in thousandths of an inch. The screws have heads of the same kind as those on safety setscrews, so that a piece of hexagon steel of the proper size can be used as a wrench.

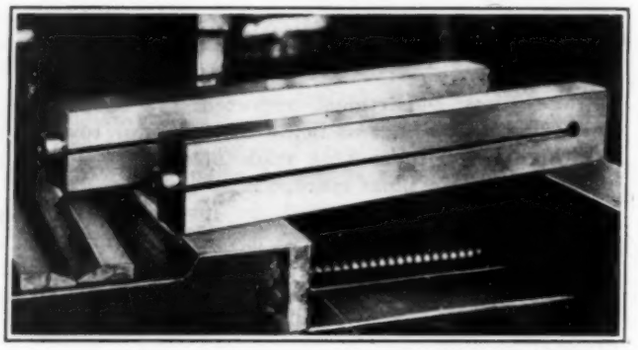


Fig. 1—Adjustable parallels

In Fig. 2, the parallels are shown on a shaper, the table of which has sagged more or less so that it is out of parallel with the ram. In order to plane the work shown in the shaper vise, so that it will be of even thickness, the parallels had to be expanded 0.006 in. at the ends.

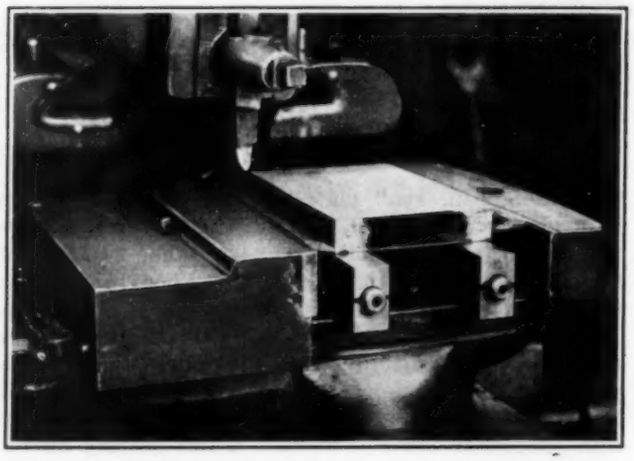


Fig. 2—Parallels expanded to compensate for sag of the shaper table

The parallels are made of a good grade of carbon steel and are hardened and ground, thus insuring accuracy and long life.

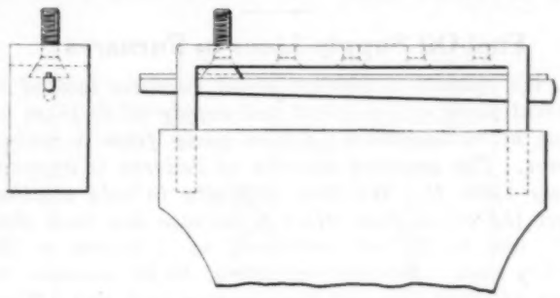
IDEAS FROM PRACTICAL MEN

Holding Small, Countersunk-Head Machine Screws

By Charles Kugler

To hold a small, countersunk-head machine screw by the head firmly enough to rethread it, or even to cut it off, is difficult of accomplishment by any ordinary means of holding, without damaging the sharp angles of the head. The device shown in the accompanying sketch does the job very neatly.

To make the device, a flat piece of machine steel is bent at right angles at both ends, any number of holes drilled and countersunk to fit the screws in the straight



Device to hold small, countersunk-head screws

part of the bar between the two bent-up ends, and a small rectangular slot drilled and broached in each of the ends at the location indicated by the sketch. The remaining portion of the device is a tapered bar, fitted to pass through the broached slots and having one of its edges narrowed down to enter the slots of the screws.

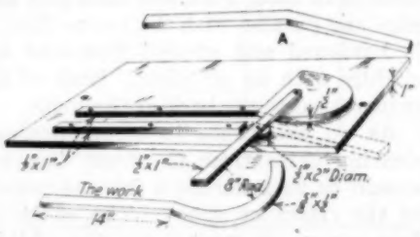
It is obvious that with one or any number of screws in the countersunk holes, with the edge of the tapered bar engaging the slots and the bar itself driven home in its bearings, the screws could not possibly be turned, even though sufficient pressure were applied to twist them off.

An Inexpensive Bending Tool

By H. L. Wheeler

On work of an experimental nature it is often necessary to make special tools or devices, upon which, because of the likelihood of a change in design or perhaps the abandonment of the piece altogether, it is highly desirable to keep the cost down to as low a figure as possible. The accompanying sketch shows a job of this character.

There were but a few of the pieces to be made, but it was essential that they should be uniform in shape and dimension, therefore a bending device of some kind was necessary to make them. The device consists of a flat plate of cast iron planed on one side only, two strips of cold-rolled steel to act as guides; a former, also of cast iron, to produce the required curve on the work, and a lever and roll to do the bending.



A cheap bending device

The former was worked out to match the curve desired in the work and was attached to the base by means of screws and dowels. A stud at the center of the radius formed the pivoting point for a lever, on which was a smaller stud fitted with a hardened steel roll.

In order to have the work enter the fixture, it was necessary to bend it at the point where the curve begins, as shown at *A*, and to lift the bending lever from the central stud. The preliminary bend was made by holding the work in a vise and using a piece of pipe slipped over the end as a lever.

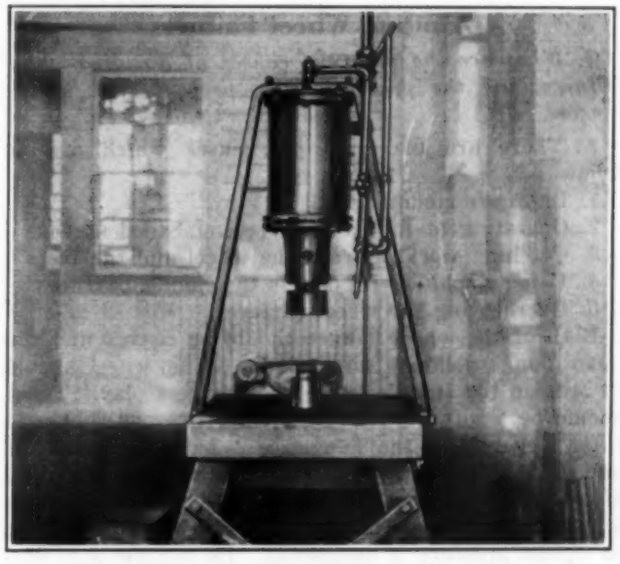
With the work and lever in place, the lever was swung about the central stud, passing the roller over the work and forcing it to take the curve of the former. The device was attached to the workbench by a couple of lagscrews. The operator acquired additional leverage by placing a piece of pipe over the end of the lever.

A Pneumatic Press

By H. M. Clary

Use has been made of a 7-in. air-brake cylinder in the capacity of both a press and hammer. The cylinder, of the type regularly used in train equipment, is suspended from a heavy iron brace that serves also to tie the cylinder to the iron table shown.

The illustration shows the method of mounting the cylinder. The iron bracket, in the shape of an inverted



Press made from an air-brake cylinder

V, is fastened to the faceplate with four 1¼-in. screws. The cylinder is hung from the peak of the bracket with two 1-in. screws.

This machine, when fitted with the proper tools, may be used either as an air hammer or as a press. It has proved serviceable for stamping and trimming sheet-metal work such as gaskets and simple shapes.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Round Instead of Flat Belt

Q. I desire to use round belt to drive a vertical shaft from a horizontal shaft. The drive is carried over two idlers and at present we use a flat belt. I believe we can do away with the bad effects of the quarter turns by changing the design to round belt. How many strands of ⅜-in. round belt will be required to equal the driving capacity of a single-thickness, 1½-in. flat belt?

A. No conclusive rules for transmission capacity can be set down on account of the variation between designs and makes of the so-called round or V-belts and we suggest you submit your problem to the manufacturers direct for their recommendations.

We question the wisdom of changing to round belt as there are likely to be unforseen troubles that will arise with a multiple installation of round belts on the drive. It might be possible, however, to get a single round belt that would do the work.

With the correct design, arrangement of idlers and correct size of pulleys there should be no trouble with the flat-belt drive. There are many such in successful use, on worse conditions than yours, where the belts are made of leather; and many where fabric and rubberized belts are used. We suggest you check carefully before you decide on the change.

Grinding Wheel Failures

Q. What are the principal causes of grinding-wheel failures, and the precautions to prevent such occurrences?

A. There are five principal causes which are as follows:

1. Improper mounting.
2. Operating at higher than recommended speeds.
3. Catching work between the wheel and the rest.
4. Using machine with play in the spindle bearings.
5. Overheating the wheel surface.

Both of the wheel flanges should be convex and the inner flange solid on the spindle. The wheel should fit free on the spindle but without excess play. There should be a soft washer of blotting paper or rubber, a little larger than the flanges, put between the latter and the wheel to compensate for uneveness on the wheel sides. Such washers are generally furnished with the wheels. The tightening nut should only be set snug as excess pressure is dangerous. Do not use a "Pittsburg Wrench."

Look for the recommended maximum speeds marked on each wheel or on tags that come with the shipments and do not run any faster. Faster speeds are not only dangerous but will not result in better service as the speed recommended is calculated to give the most satisfactory results.

Keep the work-rest, if one is used, up close to the wheel, moving it in as the wheel wears down, and do not attempt to hold the work pointing down into the crack between the rest and the wheel.

Keep the bearings lubricated and protected from grindings and inspect at frequent intervals to discover and replace worn bearings as soon as they appear.

Use judgment in pressure against the wheel and keep it dressed and free of glazing.

Fuel-Oil Supply Lines to Furnaces

Q. We operate a number of oil furnaces located in different parts of our plant and supply oil to them by means of an electrically-driven pump from a central storage. The greatest distance of delivery is approximately 1,000 ft. We have difficulty in cold weather to get the oil to flow, after a furnace has been shut down, due to the oil thickening as it stands in the delivery lines. We maintain about 50 lb. pressure by means of relief valves at the pump on each line. What can we do to correct the trouble this Winter?

A. From your statement we judge that you have no return lines and therefore no chance for the oil to circulate. It will cost something in pipe but we suggest that you install return lines making, in effect, loops from the pump that will run past the furnaces and back again. Then install the relief valves between the furnaces and the pump on the return line. In this way you can maintain a constant flow of oil under pressure to each furnace, then through the valve and back to the tank at no pressure. If your furnaces are located so one main loop can be run economically, we advise doing so, making the dead ends from the loop to the burners as short as possible. With such a system a pressure much less than you are using will be ample to circulate the oil and supply the burners satisfactorily.

Rake and Clearance Angles on Broach Cutters

Q. Please tell us the proper angles to give to the teeth of a broach as to rake and as to clearance.

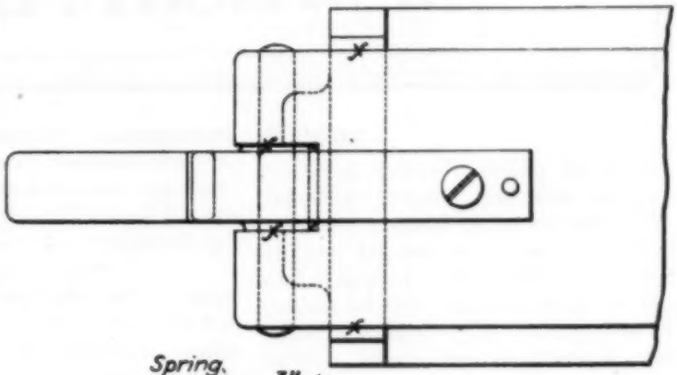
A. The rake angle can be made up to 8 deg. to properly curl the chip. The clearance angle is usually laid out between 2 and 3 deg. or even less, some broaches having practically none.

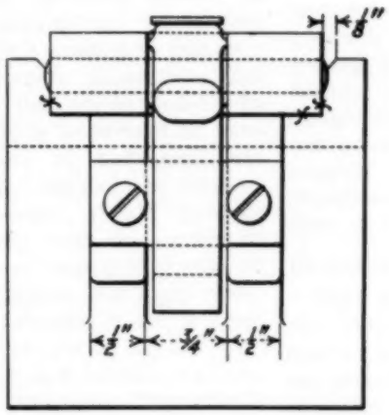
A good way to provide clearance on the top of the teeth is to make a narrow land just back of the cutting edge and parallel with the center line. After the broach is hardened and ground this land can be backed off slightly with an oil stone. Back of the land the angle is increased to the back of the tooth.

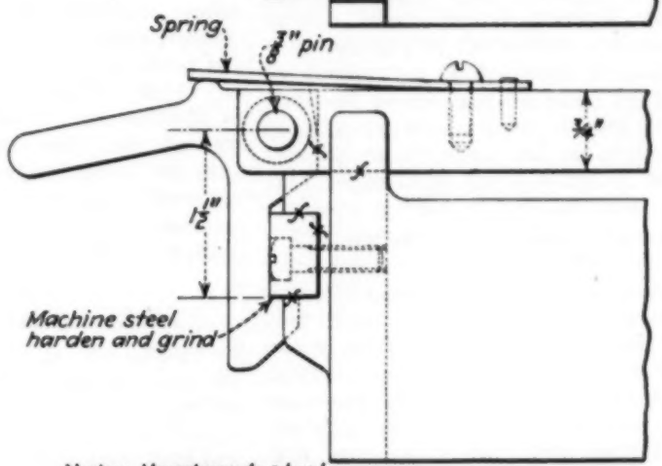
As an assistance to strengthening the cutter and clearing chips from the front face of the tooth there should be as generous a fillet as possible at the bottom of the clearance space. The effect of a curved tooth face repays, in most cases, the added difficulty in machining to obtain it.

Rapid-Action Jig Latches

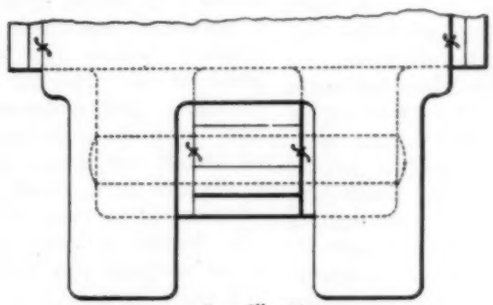
This type of leaf latch has no parts projecting above heads of bushings. It can be made larger or smaller than shown



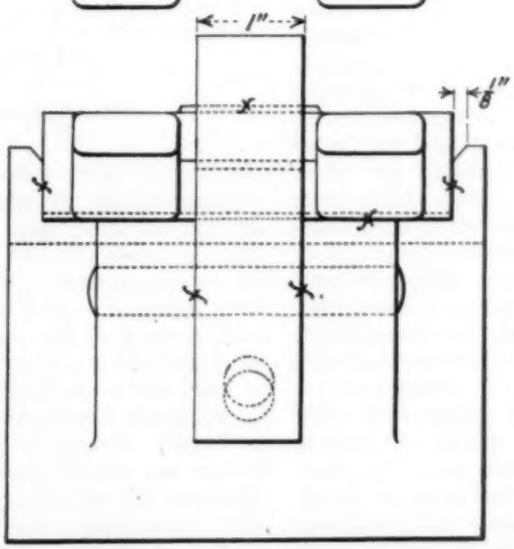


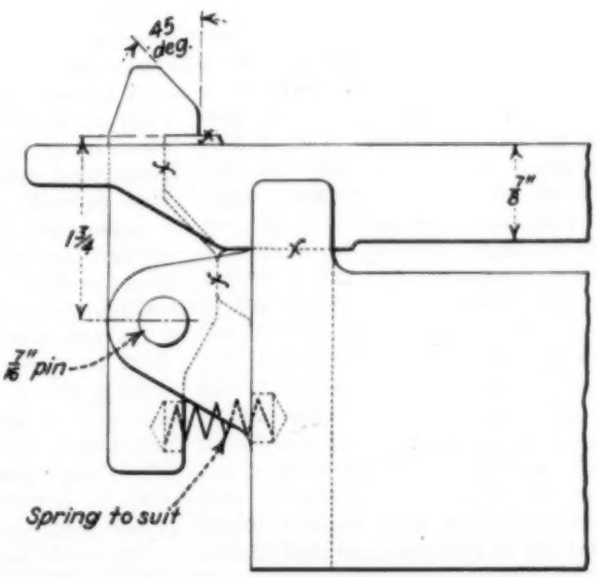


Note: Hardened-steel blocks or pins may be added, as desired to compensate for wear on both designs



This type of leaf latch may be made in smaller sizes in proportion to the sizes shown





Punch here to suit your binder

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Technical Abstracts

Some German Rules for Hand-Operated Machinery

Full automatic machine tools have reached the height of their development in Germany according to Walter Gross who thinks that tools partially hand-operated must now be given greater attention. In this connection the psychology and physiology of the workers should be particularly considered. More foot treadles should be used than hitherto, since hand levers necessitate the straining of the whole body. In emergencies it is important to have stopping levers so arranged that they are pulled toward the worker. Clockwise turning should produce movement away from the worker or to the right and counterclockwise, of course, the opposite. Similarly clockwise motion should mean locking, while counterclockwise should produce loosening, and middle positions should mean stoppage. Throwing a lever to the right should give movement to the right and throwing a lever to the left should produce movement to the left. All oil holes should be accessible and, whenever necessary, marked "oil here frequently." All operations should be performed without great movement or strain on the part of the worker, who, wherever possible, should sit.

It is essential that lighting be so arranged as to give good visibility without glare.—*Die Werkzeugmaschine*, May 30, p. 286.

Scientific Management in Europe

This somewhat brief article discusses the way in which manufacturers in Europe are facing the question of how to operate profitably. European manufacturers believe that we have the proper kind of management and they are turning to us for our methods and practices. A summary is given of the work of the first International Management Congress held in Prague. Since that congress Central Europe has become profoundly stirred by the possibilities in American management methods. So far few efforts have been made in Central Europe to develop and apply scientific management. Results have been inspirational rather than informative, and engineers and industrialists of Central Europe evaluate American management methods in highest terms.

The article concludes with a paragraph that while it is natural to feel gratified over the generous praise given to American management, practice and literature, we must not overlook the possibility that the general adoption of our methods in Europe will intensify our foreign competition. In any event, we cannot afford to cease our efforts to improve our own management.—*Management and Administration*, July, p. 5.

Heat-Treating Machine Parts

This paper, by D. M. Gurney of the Warner and Swasey Co., describes the layout and heat-treating equipment that is being used by his company. There are many types and sizes of cutting tools, jigs, fixtures and intricate parts to be found in the assembly of machine tools as manufactured today. A list is given of the parts that are heat-treated in this plant, for example: centers, spring collets, gears of all types, high-speed cutters, pilot bars, tool holders and wrenches. The heat-treating department is housed in a separate, brick, fireproof building which is adjacent to the general assembly floor. A floor plan shows the layout of this heat-treating shop which is 100 ft. long and 45 ft. wide. Three quarters of this space is devoted to heat-treating equipment, while the balance is devoted to a small forge shop. A description is given both of the equipment and the carburizing methods. Two types of boxes are used, rectangular and circular, the circular box having a chimney through the center to facilitate the heating. It is the practice in this plant to standardize the width and height of the boxes, and to vary the length according to the materials being carburized. Carburizing material that has been heated more than four times is discarded.—*Transactions, American Society for Steel Treating*, July p. 84.

Welding

Oxy-acetylene welding is a reclamation process that can be successfully applied to all metals. The engine, transmission, running gear and frame of the present day motor vehicle all offer opportunities for the capable welder. The reclamation of broken lugs, cracked fenders and body panels give the welder a chance to display his skill. Even missing teeth on gears may be built up in many cases where quick repairs are the big requirement and on orphan cars reclamation by welding is the standard method of reconditioning.

The article gives many suggestions for proper welding. Probably with the exception of the mild steels, cast iron is the easiest metal to weld, but in order to secure complete penetration and fusion of the weld, it is necessary that the broken piece be correctly prepared. Penetration of thin sections of cast iron may be induced by simply bringing the edges of the break to within about $\frac{1}{32}$ of an inch from each other and then adding a little filler metal during the process of welding. When the thickness of the metal is $\frac{1}{4}$ in. or over, the break must be prepared by chamfering or veeing to enable the operator to reach the bottom of the break with the welding flame. On metal up to about $\frac{3}{8}$ in. thickness this chamfer need be made from one side of the member only. Sections over $\frac{3}{8}$ in. thick should be beveled from both sides, if the structure is such that it can be turned over during the welding. The bevel should be on an angle of about 45 degrees to the vertical, thus making an opening in the break at a total angle of 90 degrees. The proper manipulation of the welding torch comes only as the result of constant practice.

One point brought out is that the use of bronze filler for the welding of cast and malleable and steel parts is in many cases taking the place of the usual iron filler rod method. The time required in preparation and actual welding with bronze filler is usually half that required in the iron filler rod process.—*Automobile Trade Journal*, July 1, p. 71.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

What's in a Noise?

"I HEAR someone hammering—I must find out what that means," said a machine tool builder to a visitor as the two men were walking through the machine shop.

At some distance a man was found chipping a casting that was slightly large—an ordinary occurrence in almost any shop, likely to be passed by as just a part of the day's work.

To this particular machine tool builder it meant that the job needed investigating; and investigate it he did, until he was satisfied that the casting belonged to the first machine of a new design and that tools, patterns and drawings had been corrected.

Get the significance of this situation, where a few hammer blows among all the noises of a machine shop, were a signal of something wrong to a manager who wants his machines right because the parts are designed, cast and machined to size, not hand-tooled to fit together.

Rather convincing evidence that the whole plant is going right and that just about all of its customers are bound to get what they pay for and be willing to pay for what they get.

A Chance to Prove the Reliability of the Dirigible

ONE of the first essentials of public transportation is regularity and reliability. As long as the railroad schedules were for fair weather only, as they were in the beginning, the horse and wagon held its own. Air transport is facing the same conditions.

Henry Ford appreciates this and is running his airplane regularly between Detroit and Chicago and Detroit and Cleveland to demonstrate the feasibility of regular and reliable service. The National Air Transport is expected to do the same thing when its ten planes are delivered from the Curtiss company.

The dirigible has yet to prove its reliability and usefulness in this country. The Shenandoah and the Los Angeles, being operated by the Navy, have excellent opportunity for demonstrating the possibilities of lighter than air craft in regular service. It is to be hoped that the opportunity will not be permitted to pass without an attempt to demonstrate their capabilities.

It will be remembered that the Los Angeles was awarded to us with the understanding that it must not be used for military purposes. As the Navy's air program includes aid to commercial aviation, it seems like an ideal opportunity to render a real service to aviation. But at the present time the Los Angeles is minus her gas cells and the engines are being overhauled.

When the necessary repairs are made it is hoped that she will be put in commission with a definite plan for regular service. Regular trips to any distant point, to Bermuda, Porto Rico or even San Diego, for two or three months would give us all confidence in dirigibles as commercial possibilities. Occasional trips, with long periods of idleness, are not encouraging even to enthusiasts of lighter than air navigation.

The offer by a syndicate composed of men well known for commercial enterprise, to lease the Los Angeles and run it on regular schedule is timely and should receive careful consideration.

The proposal to utilize Navy men in operating the Los Angeles under the lease has two good features. It insures the proper care and operation of the dirigible and it should give the officers and crew a better idea of commercial requirements and management than they would otherwise obtain.

A Word of Warning

NOW that there are rumors of an early session of Congress it will be well to watch for the next effort of the pro-metric enthusiasts to make the use of the metric system compulsory in the United States. Unless those interested in the subject are caught napping there can be little danger of the passage of such a bill but there is always that chance to be guarded against.

While a compulsory pro-metric law would be entirely unenforceable much grief and expense to the taxpayers can be avoided if it is kept from passage. The failure to attain enforcement of the Volstead Act should be sufficient warning to keep Congress from enacting a metric law. Such a law, if passed, would meet the passive opposition of the great mass of the people who are entirely satisfied with our present system of weights and measures and the very active opposition of many citizens who are as strongly anti-metric as their opponents are pro-metric. It would not have the backing of a large number of voters that enabled the prohibition amendment to be ratified by the states. Without such support the chances of enforcing it would be considerably less than those of enforcing the Volstead Act and the resulting confusion might well be disastrous.

Let us, therefore, be on guard to prevent the passage of any such legislation. Prevention is far safer and cheaper than cure, no matter what the disease.

The Cost of Labor Turnover—How Much—And Why

By Russell Byron Williams

Labor turnover an expensive luxury that should be eliminated—Losses that can be attributed to labor turnover—Making it hard for a good man to quit

IT IS practically impossible to calculate accurately the cost of labor turnover. One reason is that of all the determining methods offered during the past decade, no one method has been universally adopted as being the most successful or resultful. Even the American Management Association has thus far failed to arrive at one accepted standard of practice in this regard. Obviously, therefore, without a basic plan for determining costs, or even a definite conclusion as to just what constitutes labor turnover, it is utterly impractical to try to figure such costs, save in a most general sort of way.

Labor-turnover cost does not stop with the expense of hiring, or the time taken up in interviewing the applicant, deciding his rate of pay, entering his name and address on payroll records, etc. To a greater or less degree the new worker must be trained. Either the foreman or some of the older employees must devote a certain amount of time to explanation of methods, showing how the work is to be done, and getting the newcomer started. This attention from others must continue until the new worker has attained the normal. And time lost in this way represents an actual outlay of money, for one of the results of such lost time is reduced shop output.

The human animal, like every other, must be allowed time to become adjusted to new surroundings. Unfamiliar environment and strange faces tend to create a sensitiveness on the part of the recently employed, which often prevents a man from appearing at his best and lowers his usual standard of production.

The new man, however efficient in his former work, requires a certain amount of time to become adjusted to a new machine. During this stage spoilage occurs through improper setting of dies, bits, etc., and the spoilage cost is directly chargeable to labor turnover.

Not infrequently unfamiliarity with the machine tool will cause damage to the tool or even an accident to the man or to a fellow worker. The possible item of repairs or accidents is therefore also chargeable to the parent item—turnover.

NEW men must be given the opportunity to familiarize themselves with their surroundings before they can be efficient. Labor turnover becomes expensive when these men hold key places in production and it is necessary for companies to hold it to as low a point as possible. One successful method of reducing this high cost is to make it difficult for the good man to find excuses to quit by eradicating all "sore spots" and profiting by the men's criticisms

Where a new man is placed in a key position, or any place along the line of production where reduced output is likely to cause complete stoppage or delay on the part of co-workers, trucks, wagons or other equipment, the idleness that so results must also be considered as turnover cost.

The enormity of labor turnover cost can be readily appreciated, when we tabulate just a few of the items that enter into its make-up as has been done in the foregoing paragraphs. Labor turnover, indeed, is a most expensive industrial luxury. "Luxury" because it can, through intelligent effort, be materially reduced. Certainly it is not a necessity, nor even a necessary evil. Labor turnover is a luxury—something we could just as well, if not far better, do without.

According to figures compiled by Sherman Service, the cost of hiring, training and replacing workmen ranges from $50 to $2,500 per man, depending upon the adaptability of the employee and the nature of the work involved. At one of our largest railway machine shops it has been found, after careful study and analysis, that the cost of labor shift is from $80 to $100 per man. This is in contrast to the experience of the Dennison Manufacturing Company (manufacturers of paper novelties), who put their turnover charge at $50 per man "on the average." Railway motormen, according to the most accurate estimates, cost from $200 to $400 per individual to change, and Colvin, in his book, "Labor Turnover, Loyalty and Output," says: "The actual cost of hiring and firing a man may run from $20 to $2,000, depending upon the kind of man and the importance of the job."

Baldly stating that labor shifts cost the machine industry upwards of $100 the man does not reveal the staggering drain labor turnover is to the industry as a whole. It is only when we fully appreciate the existing extent of labor turnover that we arrive at a place where we can comprehend, in small measure, the enormous toll exacted by this one element in business. While the machine trade is not called upon to endure the heavy turnover that some other lines experience (recent calcu-

lations place turnover in department stores at 375 per cent) yet the industry is far from being perfect, its percentage being placed at 110 by some of the most capable research engineers in America.

A recent report made to the industrial bureau of the Merchants Association of New York City, in which was incorporated the experience of 42 concerns representing 15 varied industries, and employing a total of over 40,000 men, shows the average yearly rate of labor shift for skilled and semi-skilled workmen to be 125 per cent and for unskilled workers, 265 per cent, the calculations being made on a yearly basis. The low turnover percentage given the machinery field is due, without doubt, to the fact that the majority of those employed in the industry are of a higher mental type and work under more agreeable conditions than is true of many other industries. However, the higher mentality inherent in the man and the more importance attached to the work, the more excessive the cost of labor changes, and in the writer's judgment, an average cost of $100 per shifted man is a most conservative estimate. Hence a shop employing one hundred men, must, as an average shop, hire 110 men a year to maintain the regular force. This means a loss of $11,000 annually to any shop carrying a force of men that large, and is a loss that could—and should—be materially reduced.

Selecting the "Square Peg"

More than anyone else in an organization, the employment manager can effect a reduction in the expensive item of labor turnover. Perhaps the greatest single contributing factor to high turnover is improper selection of men. Trying to make a round man fit a square job results in discontent, inefficiency and replacement. It is absolutely imperative that the employment manager shoulder the entire responsibility for selecting the right personnel. And such selection can be brought about only by accurate and definite knowledge of each job's requirements. Obviously it is impossible properly to select men if the one making the selection is not thoroughly familiar with the requirements of the work, and yet there are employment men who do not even venture into the shops to familiarize themselves with shop conditions, requirements, or possible changes and alterations. Unless the employment man does possess complete knowledge of work requirements and unless he knows more of each foreman and superintendent than is possible to learn from mere office contact, he cannot command the confidence of the operating foremen—and unless complete confidence and co-operation exists between the employment department and the various pivot men, material reduction in labor turnover cannot be effected.

The Company's Health and Labor Turnover

A high turnover percentage (and 110 per cent is too high) indicates an industrial disease. In like measure, a very low turnover may indicate an unhealthy condition due to the company's failure to eliminate the unfit. Turnover, properly speaking, is an index to the health of the company, from the standpoint of good employer-employee relationship.

Just how such relations can be bettered is quite another story. It may be said, however, that the firms enjoying comparatively low turnover are those firms who have made it extremely difficult for a man to leave employment voluntarily.

The International Harvester Company, for instance, has for years employed a most resultful (and tactful) method of keeping a good man on the payroll. They simply talk a man out of the idea of changing. Indeed, once a good man has identified himself with the Harvester Company, in any capacity, it is "like pulling teeth to make a get away"—as the men themselves express it.

In the Ford organization it requires the signature of four men before a man can be discharged. In that company, arbitrary "firing" by any one pivot man is impossible and the result is a gratifying low turnover.

Personal Contact Is an Aid

A frank, heart-to-heart talk with an employee expressing a desire to sever his connection will often bring to light kinks in supervision and cancers in management that demand immediate correction. Following the lines of least resistance, an employee will often say he is moving out of town, or is intending to take up a different like of work; whereas a tactful questioning will reveal the fact that his real reason for leaving is bad working conditions, faulty supervision, inadequate pay, etc. Any great number leaving without giving real reasons, or without due and proper notice, indicates an inefficient employment department. Every employment department should have some one tactful person assigned to the task of interviewing every employee who leaves the company, just as certain ones are assigned to interview applicants. A sympathetic approach is obviously necessary in interviewing an employee who is leaving, if the real reasons for his exit are to be secured. The slightest antagonism between the interviewer and the employee will defeat the purpose and the investigator will have had his trouble for naught.

Education is Beneficial

The shift in labor circles is not nearly so extensive today as it was in the flush years of '18 to '20. The low point in labor turnover was reached, however, in the latter part of 1922 and the early months of 1923. Since September of that year and continuing through 1924, there has been a gradual increase in this industrial evil until today it stands, for the machine industry, at the figure set forth in the early part of this article. It is imperative, therefore, that the subject be given an increasing amount of attention to the end that the impressive expense of the item be kept down.

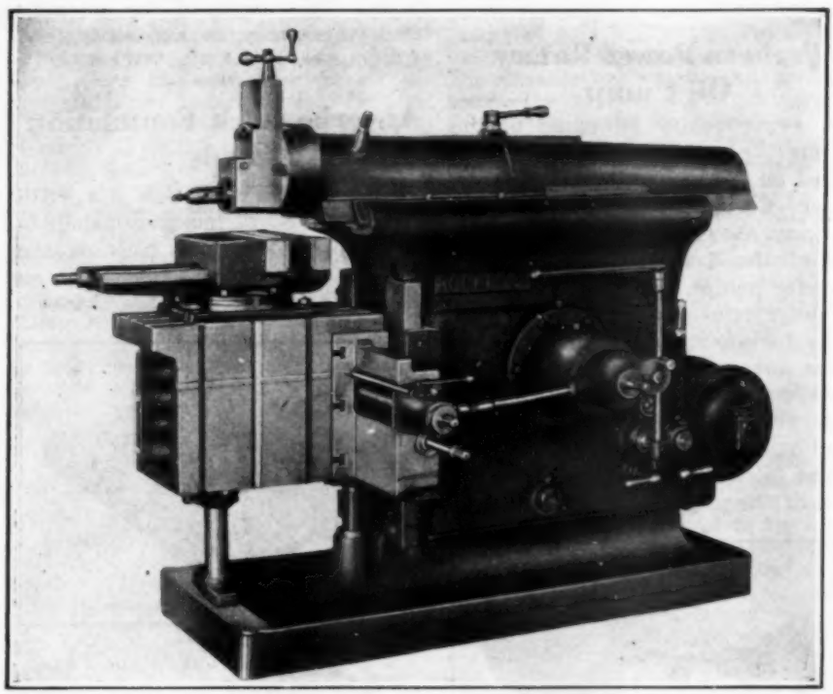
This can be accomplished in a number of ways. For instance, one firm, making textile machinery, endured a turnover of 143 per cent during the peak years of post-war prosperity. This turnover, reckoned at the average figure of $125 per man (which figure they had set after intensive study and analysis) cost in excess of $17,000 annually, for each 100 men on the payroll. Today, by intelligent application and corrected methods, their turnover has been reduced to 27 per cent, which means, in dollars and cents, a reduction in cost from $17,875 to $3,375.

Another example of what educational methods can do for employers is to be found in the foundry of one of America's largest radiator manufacturers. Where formerly this company endured a breakage of over 100 radiator sections a day, they have, by merely employing educational means, reduced that breakage to not more than eight sections a day. This reduction in breakage, if figured in terms of money, would total a handsome figure.

Shop Equipment News

Rockford Machine Tool Co. Constant-Speed Shaper

A number of improvements and features have been incorporated in the redesign of the constant-speed shaper manufactured by the Rockford Machine Tool Co., Rockford, Ill., adding considerably to its ease of control. By the elimination of cone pulleys and countershaft, the machine has been made compact, and occupies less floor space than was required by former models manufactured by the company.



Rockford Machine Tool Co. Constant-Speed Shaper

The shaper, made in four sizes, 16, 20, 24 and 28 in., is provided with angular ways, in place of the straight type heretofore used. Provision for adjustment or wear has been made by the adoption of a take-up plate on the right-hand side of the machine.

A selective type of gear shift is now used so that no gears are in operation except those in direct use. The transmission is of the all-gear type, composed of heat-treated gears that run continuously in a bath of oil. The feed mechanism is also of the enclosed type and provides for twenty feed changes ranging in steps of 0.008 in., the smallest feed being 0.008 in. per stroke. Feeds are set by a handle that rotates in a circle and that may be set easily to any desired feed. The feed may be changed while the machine is in operation. A handle is provided on the operator's side of the machine for quick reverse or forward feed travel changes.

Another added feature of the feed is an automatic-feed cutoff that may be set to any desired travel of the table. This mechanism comprises a bar that extends across the saddle onto which is fastened two adjustable collars, one on each side of the table. By this attachment it is possible for an operator to run two machines if desired, or to set the stop to a predetermined point and leave the machine, if necessary, without possible injury to the machine or work.

The clutch handle has been conveniently placed as may be seen in the illustration.

Various sized strokes may be quickly set, and a speed range of 9 to 51 strokes per minute is provided. The machine may be furnished with either a single-pulley drive or motor drive as may be required. The rear side of the body is finished machined so that if it is desired to convert a single-pulley machine to a motor drive, the change may be quickly made.

The weights of the four sizes of machines in the line are respectively 2,750 lb., 4,060 lb., 5,250 lb., and 5,400 lb. A 7½-hp. motor is recommended.

Kempsmith Circular Milling-Machine Table

The circular milling-machine table illustrated has been designed by the Kempsmith Manufacturing Co., Milwaukee, Wis., for a variety of uses in connection with its line of Maximiller milling machines.

It can be employed for milling circles, or circular segments, large cams, irregular contours, gears and, when used with a circular work-holding fixture on a vertical machine, or attachment, it will perform high-speed continuous milling on quantity production of small and medium pieces.

The base is surrounded by a flange to return all coolant to the machine table. It is arranged inside to hold a supply of oil for the driving worm. The bottom is fitted with tongues to align it on the table T-slots.

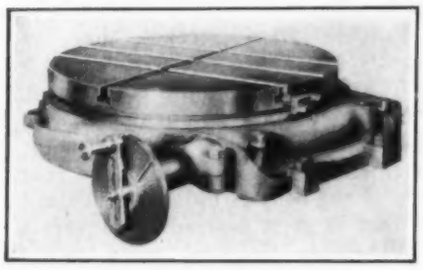
The rotating table centers in a cone bearing and bears on the base near its outside diameter. The top has four T-slots for clamping the work on fixtures and a center hole to locate a work mandrel. The rim is machined with a T-slot for the attachment of trip dogs or stops and is also graduated in degrees. A wormwheel, nearly the size of the table, is attached to its lower surface for driving it.

This wormwheel meshes with a

SHOP EQUIPMENT NEWS

heat-treated and ground steel worm, with end thrust taken on self-aligning ball bearings. The worm has provision for end play as well as side adjustment. A clamp is provided to maintain any desired setting.

The wormshaft extends from the base on both ends and is arranged for hand feed and power feed without interference with each other. On



Kempsmith Circular Milling-Machine Table

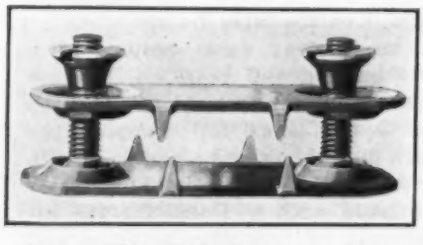
the hand-feed end an indexing attachment can be mounted that makes use of the standard dividing-head plates. The power-feed attachment is provided with trips for stopping as desired and with a reverse by which the table can be rotated in either direction. There are the same number of changes available, as can be had for the machine table feed.

The table is made in two sizes, 16-in. and 24-in., and can be supplied for hand or power feed, as specified.

Flexco H.D. Belt Fastener No. 1

The Flexible Steel Lacing Co., 4607 Lexington St., Chicago, Ill., has added the No. 1 Flexco H.D. belt fastener to its line of fasteners intended for heavy-duty transmission and conveyor belts.

The No. 1 fastener is the smallest of the line, and is designed for use



Flexco H.D. Belt Fastener, No. 1

on belts varying from $\frac{1}{4}$ to $\frac{7}{16}$ in. in thickness.

The illustration shows the general construction of this belt connector with its two clamping screws to connect the belt ends. The screws are long enough to enable the convenient assembly of the fastener, and when clamped they are cut off flush with the faces of the nuts to keep the surfaces of the fastener even with the surface of the belt.

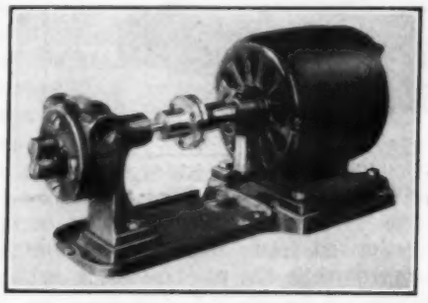
The strain on the screw holes through the belt is eliminated by the use of the clamp and spikes that take hold of the belt material.

The spikes are designed and placed at alternate points along the fastener and are driven into the belt when the screw is turned up. A series of the belt fasteners is used endways to the belt in order to reduce the strain at any one point.

Trahern Power Rotary Oil Pump

A power rotary oil pump of the "always primed" type has been placed on the market by the Geo. D. Roper Corporation, Rockford, Ill. The unit shown in the illustration is one of the Trahern line of rotary transfer pumps, built for belt, hand or motor drive and is designed especially for use in connection with furnaces burning liquid fuel or for the transfer of gasoline or oils from an underground storage tank to an overhead auxiliary tank.

The inlet and outlet are above the level of the gears so that a sufficient



Trahern Power Rotary Oil Pump

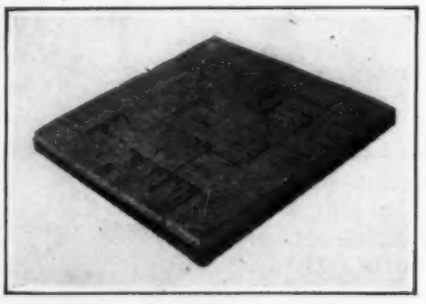
supply of oil is always retained in the housing to keep the pumps primed. The pump case as well as the front and back plates are made of fine-grain cast iron. The pumping gears are of the spiral type and are made integral with the shafts from hardened and ground steel, while bronze is the material in the packing nut.

The shaft of the pumping head is coupled to that of a $\frac{1}{12}$-hp., 1725-r.p.m. motor. The actual power required to operate against a 50-lb. pressure is 0.039 hp., while at atmospheric pressure, 0.022 hp. is used. The suction and discharge openings are $\frac{3}{8}$ in. in diameter and will transfer between 20 and 60 gallons per hour according to the draw up to 8 ft. of vertical lift. Although the recommended lift capacity is 8 ft. and the maximum back pressure is 50 lb. actual performance tests are said to have shown the pump to be capable of operating against a pressure of 80 lb. and of lifting as high as 25 feet, and that these tests are the loads that customers imposed.

The floor space occupied by the unit is 5½x12½ in. and the weight is 21 lb. The weight of the pumping head which may be had separately, is 3 pounds.

Absorbo Cork Foundation Pads

The Cork Foundation Co., 315 Fifth Ave., N. Y., has placed the Absorbo cork foundation pads on the market. The pads are intended, as the name implies, to absorb vibra-



Absorbo Cork Foundation Pads

tion from machine installations and to keep it from being transmitted to the building.

The cork as received is cut across the grain into pieces 1½ in. in thickness and then laid up into squares, the smallest of which measures 12x12 in. The cork is laid with its grain horizontal in these squares and held in place by means of ½- x ⅛-in. band iron which is bent and riveted in place. Larger units are made up from multiples of the smaller ones or built to specified special sizes with lateral braces of the band iron at the proper intervals.

After the units are complete, they are creosoted to retain the natural oils and to render them impervious to moisture.

News of the Week

Mid-Summer Finds French Metal Industries Facing Financial Difficulties

Threatened labor upheavals and higher taxation imminent

Though parliament has adjourned, financial affairs in France are the foremost topic since the finance bill and the modus oparandi of the new gold loan were left for the public to think over during the dog days. It is a question of how much fresh money the latter will bring to the national treasury from the fact that the bonds are issued only to holders of Defence Bonds, which first have to be acquired.

France with its multifarious preoccupations has an apparent air of tranquility and well-being more noticeable than that of any other European country. This is probably fictitious. As yet there are few signs of unrest in the coal mining industry in France, except in the government mines of the Saare. Here the workers, encouraged by their German and Belgian fellows, are claiming that their wages are not sufficient to meet the difficult living conditions in that district. The French minister of public works has promised to investigate the value of this claim in spite of the fact that wages had recently been raised.

Fear Another Increase

The crisis in the Belgian metallurgical industry has not yet made itself felt in France, but sooner or later there is bound to be some sort of a sympathetic demonstration, particularly if another 2½ per cent reduction takes place in the wages of Belgian workers in the metal trades, as it may before March first next.

The Luxembourg international metallurgical convention, originally fixed for the last of July, has been postponed to some future date, in view of the unpreparedness of the German delegates. The real significance of this move is not clear, but it is leading to vague apprehensions in France.

Italy is still demanding scrap iron from France in quantities in excess of that which the French government is prepared to allow to be exported, unless a *quid pro quo* be granted. Of Italy's imports of 292,000 metric tons of scrap in 1924, France supplied nearly 60 per cent. France is willing to continue this exchange but demands that Italy permit the free entry of French metal products.

General statistical tables of price indexes in France still show an upward trend, as was thought likely as a result of the new fiscal bill. Industrial materials, foodstuffs and general living costs are all affected. Average wages of 4 francs 50 centimes in 1911, have risen to 21 francs and 23 francs in three chief industrial districts which is a plain indication as to the extent which labor costs enter into French manufactures.

The automobile industry has received another blow in the shape of the newly imposed horsepower tax. A 20-hp. car now pays approximately 2,600 francs yearly for running on the road (with a surtax of fifty per cent in Paris); and the small 9-hp. cycle car, 480 francs. The advance is virtually 200 per cent above the rate in force previous to July first. The manufacturer and the owner are alike complaining that it means the strangling of the industry.

Automotive Exports Help

Exports of automobiles for the first four months of the year reached 17,306 units (as compared with 15,825 in 1924), and the chief hope of prosperity in the French industry is that these proportions of increase will continue as time goes on. Imports of automobiles, however, reached 8,424 units, as compared with 4,276 the previous year.

The small car maker in France is the one to profit from the situation and at least two of these are known to be buying machinery in the United States. The same methods applied to the manufacture of higher powered cars might cut their manufacturing costs somewhat but they would still be hampered by the abnormally high and ever increasing taxation. The new scale favors the small car at the expense of the bigger vehicle and it is no question of manufacturing ability or skilful design which has brought this about.

Tools and Hardware Decrease

Five months imports of tools, hardware and machinery, and parts from the United States reached the valuation of 190,265,000 francs, which was a falling off from those of the same months in 1924. It was, however, an increase of forty million francs over the 1923 figures.

The Franco-German commercial agreement which was expected to go into effect in the early summer, was not even consummated and further negotiations have been postponed until September when it will again come forward just at that very critical time when the guaranty pact will be up for discussion in its final details. France and other nations are fearful of the outcome when Germany's manufactures are diverted to channels which at least should give place to a share of the traffic of other manufacturing countries. This question was raised at the Brussels meeting of the International Chamber of Commerce, and Belgium herself went on record as protesting against being sunk in the flood of bigger nations scrambling for trade abroad while Germany, as a favored exporter, was getting the cream.

The commercial registry records of Paris show that the foreign manufacturer and tradesman is getting an increasingly firm foothold in France. From August, 1920, to June, 1925, the number so registered was 25,438. This increase is something unbelievable as compared with former figures, but must be taken as fact and of real significance since it is evidently considered that the French interior market is something worth going after, if selling methods could be adopted which would produce results. American products of a suitable kind are continually finding a direct outlet in France and many of them are of a mechanical nature which warrants their being classed as tools and machinery, though sold to the private consumer.

Farm Machinery Exports Increase in 1925

Exports of agricultural implements from the United States during the twelve months ending June, 1925, were valued at $62,977,914, as compared with exports amounting to $60,905,380 in the twelve months ending June, 1924, according to the Agricultural Implements Division of the Department of Commerce. This was an increase of $2,000,000, most of which occurred in the first six months of 1925. The May exports amounted to $6,002,641 while those in June amounted to $5,632,800. This shows a decreasing tendency in the latter part of this period, but the June exports were exceeded by only one month in the latter half of 1924, and were approximately a million dollars greater than exports in June, 1924.

The outstanding increase in the fiscal year was in shipments of wheel tractors to foreign countries. A total of 30,040, valued at $16,847,447, were exported during the year and exceeded exports in the fiscal year ended June, 1924 by $4,000,000. This compares very favorably with tractor exports in 1920 in which year they reached their peak, but no exact comparison is possible due to the manner in which tractor exports were classified in 1920.

The past fiscal year was an encouraging one for exporters of agricultural implements in that the exports of implements continued the increase which began after the decline in exports in 1921.

Steel Companies' Merger Gains Control of Market

The merger of seven independent cold drawn steel manufacturing companies, in the East, involving a total value of about $20,000,000, has been announced following a meeting at Beaver Falls, Pa., on Aug. 10 of the directorate of the companies.

The Union Drawn Steel Co., of Beaver Falls, and the Union Drawn Steel Co., of Gary, Ind., are considered the principal factors in the merger, which comprises also the Standard Gauge Steel Co., Beaver Falls; the Peerless Drawn Steel Co., Massillon, Ohio; the Frassee Steel Co., Hartford, Conn., and the Frassee Steel Co., of Hamilton, Ontario.

Competition over Western business owing to the abolition of the Pittsburgh-plus plan is understood to be the reason for combining the companies. It is believed that with the combined operation, reduction of shipping costs can be effected on both raw materials and finished products by the shortening of the shipping distances. An order to one plant from a distant point can be filled by shipping from the plant nearest the purchaser. It is figured also that there will be a material reduction in overhead costs.

The amalgamation of these plants is considered to mean practical control of the cold-drawn steel output of the country. With the announcement of the agreement to merge, following the directors' meeting, it also was stated that the control of the concerns involved will be vested in the Union Drawn Steel Co. The central office will be in Beaver Falls.

Louis R. Davidson, of Buffalo, N. Y., president of the Union Drawn Steel Co., will be chairman of the board of directors of the amalgamated concern, and Eugene S. Hoopes, president. The other officials named are: Vice-president and general manager, E. H. Birney, heretofore president and general manager of the Peerless Drawn Steel Co ; second vice-president and assistant secretary, Clifford H. Beegle, of Beaver Falls; secretary and treasurer, Edward C. Robeske, of Beaver Falls, who had the same position with the Union company there; assistant treasurer, Herbert A. May, of Sewickley, Pa., general manager of the Standard Gauge Steel Co.

Hardness Testing Program

One of the important sessions to be held during the seventh annual convention and exhibition of the American Society for Steel Treating, in Cleveland, Sept. 14 to 18, will be the symposium on hardness testing. The work of the hardness testing committee of the National Research Council has been turned over to the A.S.S.T.

The A.S.S.T. committee has been making an investigation of the subject of hardness which bears such an important relation to physical properties.

This symposium will be held Thursday afternoon, Sept 17, at the Hollenden Hotel. The committee, under the chairmanship of Major A. E. Bellis, will present the following program:

"Herbert and Vickers Hardness Testing Machines," by Prof. O. W. Boston, of the University of Michigan.

"Checking Brinell Machines," by Capt. S. N. Petrenko, of the United States Bureau of Standards.

"Hardness of Cold Rolled Nickel," by Dr. S. R. Williams, director of laboratory, Amherst college.

"Comparison of Brinnell and Rockwell Readings on Carbon and Alloy Steels, Brasses and Bronze," by R. C. Brumfield, of the materials testing laboratory of Cooper Union, New York.

"Hardness Testing," by Robert Barry, of the Barry Co., Muscatine, Iowa.

Reduced Tariff on Parts

The Swedish Riksdag recently passed the recommendations of its finance committee to reduce the import duties on parts of automobiles. The committee recommended that an ad valorem duty of 10 per cent should be placed on parts of automobiles, not specially mentioned in the tariff, but that the duty on specially mentioned parts, such as engines, springs, ball bearings, etc., should remain unchanged. The present average duty on parts not specially mentioned amounts to 26 per cent ad valorem. The amendments are to come into force at a date to be determined by the government.

Foreign Products to Be Made in America

European manufacturers are expected to establish plants in this country at an increasing rate, reports reaching Washington indicate. They gradually are becoming convinced that the present level of import rates is likely to continue for an indefinite period. In addition, many of them until recently were faced with such uncertainties at home that they were not in a position to dilute their capital resources by erecting plants abroad.

With the improving world situation many more foreign manufacturers are expected to begin production behind the tariff wall which their European-made products cannot hurdle. This development was foreseen while the tariff bill was under discussion. It was the opinion of the principal authorities on tariff matters among the lawmakers that such action was in the public interest, as such establishments then would support American standards of living by paying wages at American rates and by buying most of their raw materials and most of their supplies in American markets.

At the same time this is certain to bring formidable competition to American producers of competitive articles, as some of these branch plants will have the support of powerful cartels, or organizations of that type. They enter the American field with long experience in merchandising their products and are backed by intensive research work being conducted on behalf of the parent companies. The tariff lays no levies on ideas or improved processes which are coming into being rather prolifically under the pressure of necessity.

Hoover Predicts Good Business Era

In his discussion of conditions in the country, as gained from his own observations and those of investigators in the Government, Secretary Hoover gave President Coolidge a review of the economic strength of the country. He did not overlook the bad spots such as appear in the textile industry in New England and the anthracite regions of Pennsylvania. But with these exceptions and the slow restoration of good returns to the farmers, Mr. Hoover said, the United States had never been upon such a solid economic basis as at present.

In his trip to the Pacific Coast Mr. Hoover said he found that the people were thinking in terms of taxation and business prospects. The administration, he indicated, had gained strength in its program of allowing business to go ahead without constant discussion of new legislation. Among the people the thing that has given the President his present hold is his persistence in reducing taxes and keeping down Government expenses, he said.

There is no fear among Administration advisers that a hard coal strike will occur. But even conceding that the deadlock results in a strike, the Administration officials say that it cannot be lasting.

It is argued that a hard coal strike will not affect present prosperity or bring hardship to the homes as was the case in 1923. It is because of this fact and the definite purpose of the President not to inject the Government into disputes between labor and capital that President Coolidge does not intend to act in any peremptory way in September should a strike come.

In the meantime he is going ahead giving earnest study to taxation, the World Court and, above all, consolidation of the railroads, with their effect upon farm conditions.

The casual observations which the President made recently upon the advisability of voluntary railroad combinations has evoked many favorable comments.

Improvement of railroad shares last week is traced directly to the influence of President Coolidge's views. It is apparent that the railroads are enjoying great activity. In addition to having heavy loadings the railroads have shown a distinct improvement in efficiency of operation. A decision to permit business to go along unperturbed by fear of tariff revision and the certainty that more tax burdens will be lifted from business incomes are two factors that are working to make prosperity permanent and produce the best era since the war, according to Secretary Hoover.

Large Order Coming

The Chicago Rock Island & Pacific Railway Co. has applied to the Interstate Commerce Commission for authority to guarantee an issue of $5,400,000 equipment trust certificates to apply on the purchase of new equipment to cost $4,729,536.40, and for the rebuilding of old equipment at a cost of $2,565,000.

Plans Complete for Welders' Meeting

Plans are practically completed by the welding industry to make the fall meeting of the American Welding Society the largest and most successful ever held. Three days, Oct. 21, 22 and 23 will be devoted to the various technical sessions, demonstrations, exhibits and entertainment. The headquarters for the meeting will be at the Massachusetts Institute of Technology, Cambridge.

Exhibits of welding, welded products and actual demonstrations of welding and cutting are to be featured at this meeting. Some of the leading industrial executives of the United States are expected to be present. The applications of welding have more than trebled during the past few years, and possibilities for further extension with resulting economies are still limitless. It will be the object of these exhibits and demonstrations to show industrial managers and engineers what can be done.

Five technical sessions on important subjects are scheduled. The papers will be printed and distributed in advance and the greater part of the time of each session will be given over to a discussion by those present. Time for play as well as work is also provided in the program, including entertainment for the ladies.

The schedule for the meeting is as follows: *Exhibitions and Demonstrations:* Wednesday, Thursday and Friday 9 a.m. to 5 p.m. and Wednesday evening, 7:30 p.m.

Technical Sessions: Wednesday morning, "Thermit Welding". J. H. Deppeler, chief engineer, the Metal and Thermit Corporation. Wednesday afternoon, "Gas Welding of Power Plant Piping," author to be announced later. Thursday morning, "Industrial Applications of Arc Welding and Economies Effected Through Its Use," joint paper by H. M. Hobart, chairman, Electric Arc Welding Committee and W. Spraragen, secretary. Friday morning, "Selection of Materials for Welding." A series of short addresses by several speakers. Friday afternoon, "Spot Welding of Automobile Bodies," J. W. Meadowcroft, General Supervisor of welding, the E. J. Budd Manufacturing Co.

Research and Business Session: A meeting of the research department of the society (American Bureau of Welding), will be held Thursday afternoon. The program will include a review of present activities and an outline of future investigations.

For the convenience of members and guests, lunches will be served at cost on each day at the cafeteria of the Massachusetts Institute of Technology.

Motor Transport Congress in New York Next Year

Invitations have been sent to all countries of the globe inviting automobile men everywhere to attend the second World Motor Transport Congress which will be held in New York, Jan. 11 to 13, 1926, during the National Automobile Show. Assurances of participation have already been received from fifty countries speaking sixteen different languages.

The National Automobile Chamber of Commerce is the host on this occasion, which is a continuation of the first Congress held at Detroit in May, 1924.

The economics and utility of motor transport were the chief topics at the first conference. This time emphasis is to be placed on sales, advertising and service methods.

Special Reduction Gears for New Steamship

The contract for the four sets of reduction gears for the steam turbines of the steamship *Malolo* has been awarded. The *Malolo* will be the largest and fastest high-powered passenger steamship ever built in the United States.

Each of the vessel's four sets of the reduction gears will consist of one main gear with one high-pressure and one low-pressure pinion mounted in the gear case. Each gear set will be housed in a separate casing. The gearing will be of the double helical type, the gear face being divided into halves with right- and left-hand teeth.

The gear wheels will have cast iron centers with forged steel rims shrunk on and secured by screw pegs. The gear rims will be of forged carbon steel, double annealed with a tensile strength of 65,000 lb., elastic limit 35,000 lb., and elongation in two inches of 32 per cent. The pinions will be nickel steel forgings, oil quenched. They will be tempered with tensile strength of 90,000 lb., elastic limit of 60,000 lb. and elongation in two inches of 25 per cent.

The lubrication of the gear teeth will be by means of a series of spray nozzles arranged to deliver oil at the point where the driving teeth enter in engagement when the gear is running.

Canadian Industries Backward in 1924

According to a preliminary statement just issued by the Dominion Bureau of Statistics, the 1,004 concerns in Canada engaged in the manufacture of iron and steel and their products in 1924 had a combined production valued at $368,476,650. Representing a total capital investment of $535,539,833, these industries employed 78,240 persons during the year.

Lessened activity was general throughout the industries of this group. Tonnage production of pig iron and ferro-alloys was about 32 per cent lower than in 1923. Steel and rolled products fell off accordingly; castings and forgings decreased 17 per cent in value, and the total sales value of boilers and engines manufactured in 1924 showed about the same decline; automobile production dropped ten per cent due largely to excess output in 1923; auto parts fell off 29 per cent in value; railway rolling stock, 34 per cent. Production of agricultural implements was fairly well maintained. The production of industrial machinery and sheet metal products remained at about the level of 1923.

Report Progress in War on Waste

The war on waste in American industry which is being waged by various industrial groups in co-operation with the division of simplified practice of the Department of Commerce, was continued with increasing vigor during the second quarter of 1925, stimulated by reports of millions of dollars saved annually by groups which have already simplified the variety of commodities they produce, distribute or use. Estimated savings of nine groups total $293,600,000 annually.

Reporting to Secretary Hoover, who instituted this co-operative service of the department, Ray M. Hudson, chief of the division, states that during the quarter more than forty conferences were held in which groups either adopted simplified practice programs or met to initiate simplification projects or to revise existing simplifications adopted heretofore.

Initial steps were taken in preliminary conferences to obtain full information as to sales and production upon which to base recommendations for simplifications. These were begun in the following commodities: Automotive taper roller bearings, automobile poppet valves, bank checks, commercial baskets, bathroom fixtures, fruit and vegetable crates, glass sidewalk and skylights, hot-rolled steel in coils, mops, office desks and tables, plywood thicknesses and sizes, power boilers and accessories, railway shop tools, seed nomenclatures, tacks and nails, and yarns.

Suggestions made to the division for the possible simplification of variety in other fields are expected to result in preliminary conferences to initiate action in the following fields: Carbon brushes, tool and wood handles, steel coiling equipment, railway shop tools, brass valves and fittings, taps and dies, packing boxes and rods, automobile poppet valves, mop weights and sizes, warm air furnaces and warm air registers, stoves, heating and piping supplies, binder board, box board, finished boxes, and tissue paper.

A number of the subjects referred to the division for action have been brought to the attention of the American Engineering Standards Committee, to the Society of Automotive Engineers and the Rubber Association of America, these bodies having at their command facilities for technical research and already co-operating in the development of standards and simplifications.

Enlargement of the advisory committee of the division, by the inclusion of L. W. Wallace of the American Engineering Council, Brig. Gen. H. C. Smithers, Chief Co-ordinator of the Bureau of the Budget, and B. H. Ackles, president of the National Supply and Machinery Distributors' Association, has made this body more completely representative of the elements chiefly concerned with the elimination of waste through simplification. At the same time the close liaison between the Division and the Chamber of Commerce of the United States, and many leading technical and scientific organizations is maintained.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE overtones of American business at present are harmoniously optimistic. Car loadings for the week ended Aug. 1 again reached a new high level, an increase of 13,460 cars over the record of the previous week. Bank clearings are large and growing steadily larger. In the iron and steel trades an expectant hopefulness prevails, and the much-heralded return of agricultural prosperity seems to be an accomplished fact. The only discords to be heard in this melodious symphony are those sounded by a few conservative business leaders and economists who see the possibility of over-expansion. Early last week a warning was issued by Samuel D. Insull, Chicago's leading figure in public utilities, against speculation in the securities of power companies. According to Mr. Insull, many of these securities, chiefly those of holding companies, are now selling at values entirely unjustified by earning power and financial strength. A similar warning against the danger of overbuilding has been issued by the Bureau of Labor Statistics. Another straw in the current is the continued rise of commodity prices. Bradstreet's index number has now reached a point higher than any recorded since November, 1920, and shows an advance of 12.8 per cent over August, 1924, although still 31.7 per cent below the peak of February, 1920. No such advance can be explained solely by reference to specific commodities. The chief answer is to be found in the growing volume of bank loans and discounts. A rising price level is said to have a bouyant effect upon business, but it also carries the threat of price inflation with all of its attendant disorders.

The stock market still moves in circles without showing any definite direction, in spite of a large daily turnover and strenuous efforts to bring about a general forward movement. The advances of one day are about offset by the declines of the next. Instead of the seasonal transfer of funds from New York to the West at this time of year we are now witnessing an unusually heavy movement from the West to the East. One Kansas City bank is said to have $22,000,000 loaned on call in New York, while another news dispatch tells of large investments by Nebraska and Iowa banks in Wall Street securities. This indicates the agricultural prosperity of the West.

When we look under the surface of the cheerful reports from the iron and steel trades it is a little difficult to ascertain the cause of their optimism. It is true that the unfilled orders of the U. S. Steel Corporation showed a smaller decline than at any time during the past five months and that the Western demand for both iron and steel is improving. On the other hand, a sale of Dutch iron was reported out of Providence at $20 a ton, or $1 under the market for that district. We also learn that the efforts of the steel trade are being directed toward a maintenance of present prices rather than an advance.

What's Doing in Industry

The unusual machine tool business that was reported from industrial centers in the past few weeks seems to have reached the peak. While there has been no recession, there has been no noticeable increase in the number of new orders. There have been fewer inquiries reported, and this has probably been the reason for the slackening of activity.

Orders for special high-production machines are more frequent, but there is also a more active demand for machines of the standard type.

The Mid-West retains its leadership, with Detroit reporting increased activity in line with the heavy production of the automotive industry. Cincinnati plants are busier than in several weeks, more orders but fewer inquiries being reported. Milwaukee dealers are busier now than at any other time this year, the demand showing a tendency to get back to standard machines.

In the South the optimistic crop outlook has given new impetus to industrial projects and expansion of several lines is expected to bring business to machinery manufacturers in the near future.

New York continues to ride on the crest of the wave of good business that began in late June and ran through July. It is believed that business in machine tools will be better this fall than it has been in several years.

As far as the general domestic outlook is concerned, it is satisfactory, although vulnerable to influences that may change sentiment or precipitate liquidation. Vigilance in scanning the horizon is advised.

The Government crop report, issued last Monday, estimating a total wheat yield of 679,000,000 bushels, came as a distinct surprise to the grain trade, as earlier private calculations had indicated a crop ten to thirty million bushels smaller. The Canadian government estimate of 375,000,000 bushels was also larger than previous estimates. The first effect was to cause a sharp break in wheat prices but most of the losses were recovered later in the week. The wheat trade is now divided into two distinct camps. According to one view, the world supply of wheat this year is sufficient for all requirements, and the small American surplus indicated will not permit our markets to move far out of line with world values. The other side maintains that no such domestic surplus exists and that the 42-cent tariff on wheat imports will force our markets considerably above the world level. In any event, there is an evident tightness in the nearby cash position which is not likely to be relieved until the Canadian movement is in full swing.

Wool is somewhat higher in London, where it is asserted that a decline to pre-war levels is unlikely. This belief is based on the recent growth in the demand for stylish fabrics and the failure of the supply of raw wool to keep pace with the demand even at the present high levels.

For the first time this year the cotton market has ignored the Government crop estimate. It seems to be proceeding on the theory that the crop will be sufficiently in excess of the consumption to depress prices. This may or may not be correct; it also may be premature.

In Europe the outlook is comparatively placid, but the slow decline in francs indicates that Caillaux's debt conversion scheme is meeting some obstacles. This view is confirmed by an increase of 850,000,000 francs in the government debt to the Bank of France during the last fortnight and a gain of 400,000,000 francs in the circulation in the same period.

But this is old straw that need not be rethreshed during the vacation season. In this country the question involved is daily becoming more of an abstraction, and in so far as our domestic outlook is concerned it is satisfactory although vulnerable to influences that may change sentiment or precipitate liquidation.

Vigilance in scannning the horizon is therefore advised.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

With two-thirds of the month already gone, August shows signs of weakening. The remarkable volume of business that was recorded in June and July was expected to continue into August, but signs now apparent point to a gradual slowing up in orders, although the present volume is far better than last year, and indications are that in this market the year 1925 will be considerably ahead of 1924.

Demand for machine tools and shop equipment is not confined to any one particular type, although grinding machines and presses are showing up better. Manufacturers of hardware and electrical supplies are quite busy and have been in the market for new equipment of a varying character.

Railroads have about finished buying for this seasonal period, but still continue to purchase tools according to present urgent needs. Automobile manufacturers have not come into this market recently, but manufacturers of automotive accessories are busy and are taking up new equipment as increased production makes it necessary.

The foreign market continues dull, with orders coming in spasmodically for special machines designed for some particular work.

A few of the orders recorded the past week were: The Pullman Car Manufacturing Co., a 48-in., 500-ton wheel press; the Havanna Central R.R., a 96-in., 600-ton wheel press; the Hallidie Machinery Co., a 600-lb. steam hammer; the C. F. Braun Co., a 60-in. x 21-ft. lathe; and the Bridgeport Brass Co., six 16-in. x 6-ft. toolroom lathes.

Chicago

Mid-August finds the Chicago machine tool market inactive, with indications pointing to continued dullness for the next three or four weeks. Dealers in used machinery report business for July as satisfactory, sales being in excess of those of the same month in 1924.

Inquiries for new and used machinery are reported by some of the larger houses to be seasonal, and the forecast is made that a fall trade of greater proportions than last year is practically certain. No notes of a pessimistic nature are sounded with respect to business in the near future, notwithstanding that industrial production in the Middle West, particularly in Illinois, has fallen off in the last few weeks. This is characterized as normal, however, and excites no concern among machinery interests.

Railroads continue to buy in small lots, no sales of importance being recorded. The Board of Education is not closing bids as promptly as was expected, and, according to one dealer, its representatives are seeking to make the occasional trading of obsolescent or discarded machine tools a factor in the transactions, an idea not viewed at all favorably by bidders.

Southern District

The machine tool and equipment trend in the Southeast has continued slightly upward in the past two weeks, while the outlook for the last half of the month promises still better business, dealers state. Considerable new industrial construction is in progress all over the South, and this continues one of the main sources of sales.

With marked improvement noted the past month or so in textile production, and orders materially larger than at this time last year, this industry is buying again on a fairly active basis, inquiries indicating continued activity for some weeks to come.

Service stations continue fairly good buyers of used tools and equipment, while some improvement is noted in sales to the smaller machine shops. Railroads also are still fairly active in the market for heavier tools and equipment, but are not buying as much as they were two months ago. The low level of lumber prices in the hardwood market is affecting sales of woodworking equipment to some extent, though the lumber and furniture industries are still buying machinery, particularly in the Georgia, North Carolina and East Tennessee territory.

With excellent agricultural prices prevailing and large crops in prospect all over the South, a period of agricultural prosperity is assured and hence dealers consider the fall outlook good.

Construction and road building machinery continues active due to the large amount of new construction now in progress all through the South.

Cincinnati

Cincinnati machine tool manufacturers report that plants have been fairly busy the past week, with a slight increase in the number of orders received. While the number of inquiries coming in is normal for the season, the sales-resistance is great and it is unusually difficult to close orders. Prices are stable, and there is no indication of reductions.

The demand for machine tools does not seem to be greater in one section than in another, and it seems to be evenly divided as to types and sizes of tools. The great majority of orders reported for the week were for replacements, from which fact it is apparent that users of machine tools are not at this time making preparations to increase their output to any material extent.

Several fair-sized orders are reported from the automotive industries, and an increased amount of buying from this source is expected in the near future. Railroads have ordered a few tools and have sent in many inquiries, but the purchases from this source continue to be far below the actual needs.

A few export orders have been received, but this market is rather quiet. Investigators who have gone abroad report that many prospects are in a receptive mood, but cannot buy because of inability to finance operations.

Concerns in general lines of manufacture are preparing to increase their activities in the fall, thus either directly or indirectly increasing the demand for machine tools.

Detroit

The record production of automobiles that is being maintained by practically every leader in the industry is keeping the market for machinery and machine tools lively, with an increasing demand for special machinery which will reduce labor costs.

The summer months so far have been the best for the corresponding period in any recent year, and there appears little likelihood that sales will decrease materially for another month.

Several plants, notably Briggs and Hudson-Essex, are planning extensions which will require thousands of dollars worth of machinery. The Ford Motor Co., in line with its policy to centralize all possible activities at the River Rouge plant, is buying considerable new equipment for the motor assembly line. The Board of Education, of Detroit, is purchasing wood-working machinery and other manual training equipment for the technical schools soon to open. A large addition to the powerhouse of the Paige plant is being constructed, while additional machinery will be bought by the Gotfredson Body Corporation for a new three-story 540-ft. unit now under construction at Wayne.

The recent purchase of the Stout Metal Airplane Co. by the Ford Motor Co., and the announcement that Ford will enter into real production of planes and engines, has given the aircraft industry in Detroit an impetus which should mean large orders in the machine tool field. The Stout Metal Airplane Division of the Ford Motor Co., as it will be known, will be in charge of William B. Stout who will superintend the additions to the Dearborn plant and the purchase of new machinery.

Outside the leading motor car plants the demand for machinery and machine tools is somewhat spotty. The market for used tools is slow.

Milwaukee

Manufacturers of metal-working equipment in this market are probably busier than at any time since March in executing orders that have been booked for prompt delivery, but dealers report that the demand in the first half of August has not been as active as in June or July. The situation is considered about as satisfactory as might be expected as Summer passes, and in some instances the condition of business runs well ahead of the corresponding period a year ago.

Production of equipment is slowly getting back into what may be called standard tools, although the main effort at this time continues to be to put out specialized equipment which manufacturers, principally in the automobile industry, have designed to meet their particular requirements for toolroom as well as production work. There is a fair call for replacements as well as special attachments, which is keeping this department of most tool shops busy.

The changing trend in demand from special to standard tools doubtless is the reflection of the enterprise which machine tool concerns have been showing for the past year or two by redesigning their stock types of equipment so that these will have the greatest possible range of purpose, as well as an augmented production ability.

It is felt that the manufacturers of equipment may look forward to a steadily increasing business of the kind that formerly was accomplished within users' own shops, mainly as a matter of expediency, as in the case of the larger automobile shops which have been having an uneven rate of output, but are believed to have reached a readjustment that will straighten out the production curve.

Automobile parts makers in Milwaukee and vicinity are buying some equipment, both for replacement and to acquire somewhat greater capacity, but the total volume of purchases is rather light. The expectancy, however, is for a gradual increase as fall approaches, with its usual heavy demand for units and parts for delivery through the winter and spring season.

Publishers Unite in Export Field

Establishment of the Business Publishers International Corporation to meet more adequately the demand for specialized business publications in the fields of overseas trade and industry was announced last week by the McGrow-Hill Co. and the United Publishers Corporation. They jointly will control the new organization.

Three publications already in existence form the nucleus of the new company, which will maintain editorial and business representatives in the important commercial centers abroad. The papers are *Ingeniería Internacional* (International Engineering), a McGraw-Hill industrial and engineering monthly circulating in Spain and Latin America; *El Automovil Americano* and *The American Automobile* (overseas edition) in Australia, New Zealand, South Africa, India, Great Britain, Norway, Denmark, Holland, Belgium, in the Orient and other territories.

The new corporation is headed by Mason Britton, president. He is vice-president of the McGraw-Hill Co. John Abbink, until the formation of the new publishing firm business manager of *Ingeniería Internacional*, is vice-president and general manager. J. L. Gilbert, who was business manager of the two automotive publications, is vice-president and Secretary. C. A. Musselman, president of the Chilton Class Journal Co., the automotive publications division of the United Publishers Corporation, is treasurer.

The Board of Directors includes, in addition to the officers, Charles G. Phillips, president of the United Publishers Corporation; Malcolm Muir, a vice-president of the McGraw-Hill Co.; Philip S. Smith, editor of *Ingeniería Internacional*, and George E. Quisenberry, editor of *El Automovil Americano* and *The American Automobile* (overseas edition).

"Tremendous development is taking place in overseas trade and industry," said an officer of the corporation in its offices at 225 West 34th St. "The demand for specialized business papers, which developed and has been met in this country, is growing in industrial and trade centers abroad. Organization of the Business Publishers International Corporation is in response to that demand and to meet it more effectively. The corporation will follow the activities of the parent companies.

Leading Industrialists Join Conference Board

Significant enlargement in membership of the National Industrial Conference Board was announced recently, following the election of thirteen members-at-large representing a number of the largest industrial organizations in the United States.

The new members-at-large, elected for two years, are: A. C. Bedford, chairman, Standard Oil Co., of New Jersey; Charles F. Brooker, chairman, American Brass Co.; W. L. Clause, chairman, Pittsburgh Plate Glass Co.; Philip T. Dodge, chairman, International Paper Co.; Irenee du Pont, president, E. I. du Pont de Nemours & Co.; Eugene G. Grace, president, Bethlehem Steel Corporation; Hon. Alanson B. Houghton, ambassador to Great Britain, chairman Corning Glass Works; Leonor F. Loree, president, Delaware & Hudson Co.; William H. Nichols, chairman, Allied Chemical and Dye Corporation; Guy E. Tripp, chairman, Westinghouse Electric and Manufacturing Co.; H. Herman Westinghouse, chairman, Westinghouse Air Brake Co.; Owen D. Young, chairman, General Electric Co.; George M. Verity, president, American Rolling Mills Company.

South America Buys More American Machinery

American exports of industrial machinery to Colombia increased over 25 per cent during 1924, in comparison with the previous year, and about 40 per cent when compared with such exports in 1922. Machinery items showing the greatest increase in exports to that market were construction and conveying, mining, oil well and pumping machinery, and various types of power generating equipment.

Latin American, as a whole, absorbs more than 33 per cent of the total American exports of industrial machinery. Colombia showed an increasing demand for industrial machinery in the United States in 1924. A further interesting feature of this trade is the fact that American exports of industrial machinery to Colombia in 1924 amounted to within approximately $500,000 of the peak year of 1921.

Personals

PERCY M. BROTHERHOOD, formerly first vice-president of Manning, Maxwell & Moore, Inc., of New York, has opened offices at 25 Church St., in New York City. Mr. Brotherhood will specialize in machine tools, specialties, and in consulting investigation and appraisal work on engineering projects.

C. H. ALVORD has been appointed works manager of the Ware Radio Corporation, of New York.

ALFRED R. BENSON has joined the testing department of the General Electric Co., at the Schenectady plant.

F. M. FARMER and H. F. MOORE have been designated by the American Society for Testing Materials as members of the National Research Council.

L. FREY has been appointed chief metallurgist and research engineer for the Gerlanger Electric Steel Castings Co., of West Allis, Wis.

K. C. BACKHOUSE has been appointed assistant engineer of the Ruckstell Axle Co., New York City.

P. M. BOYD has joined the engineering staff of the Curtiss Aeroplane and Motor Co., of Garden City, Long Island, N. Y.

GEORGE A. LENNOX has been appointed assistant sales manager of the Driver Harris Co., with headquarters at the main plant at Harrison, N. J. Mr. Lennox was at one time Chicago branch manager for the company.

JOSEPH J. SCHOLL has become associated with the Laughlin--Barney Machinery Co., of Pittsburgh. Mr. Scholl has been connected with the machine tool industry for several years and was formerly sales representative for the Reliance Machinery Sales Co., of Pittsburgh.

FRANK L. HESS, for twenty-three years on the staff of the United States Geological Survey, has resigned to become chief mineral technologist for the United States Bureau of Mines.

CHARLES N. BOWNE has been appointed sales engineer for the Ames Iron Works, and will be located in Philadelphia.

N. C. MCNUTT has been appointed manager of the Cleveland branch office of the Trumbull Steel Co.

F. S. VAN BERGEN has been appointed district sales manager in Minneapolis for the W. A. Jones Foundry and Machine Co., of Chicago.

JAMES W. SEDERQUIST has become associated with the Union Twist Drill Co., of Athol, Mass., as a special representative.

G. H. BUCHER, assistant general manager of the Westinghouse Electric International Co., sailed for Japan last week. He will assist in the organization of the Westinghouse Electric Co., of Japan.

HARRY Z. CALLENDER, assistant sales manager of the Whitman & Barnes Manufacturing Co., of Akron, Ohio, has been elected vice-president of the company and has been placed in full charge of sales. Mr. Callender has been associated with this company for over thirty years.

S. A. DINSMORE, who has been district sales manager in Chicago for the Standard Gauge Steel Co., has been transferred to the Chicago office of the Union Drawn Steel Co., of Chicago. The latter company recently took over the Standard Gauge Steel Co.

HAROLD BATES has joined the sales organization of the Bridgeport Brass Co., of Bridgeport, Conn. Mr. Bates has had a long association in engineering fields, having at one time been connected with the Boston Elevated Ry.

M. A. WEIDMAYER has been appointed manager of the Philadelphia office of the United States Electrical Tool Co. Mr. Weidmayer was formerly associated with the Black & Decker Manufacturing Co.

C. H. SCAFFE has been appointed special representative of the United States Electrical Tool Co. He will operate from the general office of the company at Cincinnati.

E. B. HARKNESS has been elected secretary of the Illinois Steel Co., to succeed the late Thomas J. Hyman.

E. A. SNYDER has been appointed to represent the American Society for Testing Materials on the United States National Committee of the International Electro-Technical Commission.

H. S. JANDUS has been appointed chief engineer of the C. G. Spring and Bumper Co., Detroit. Mr. Jandus was formerly research engineer. W. E. Dunston, formerly chief engineer, has resigned to become associated with Jenks & Muir, of Detroit.

C. E. BOYD has been made works manager of the Newman Foundry Co., of Kendallville, Ind. Mr. Boyd was formerly sales representative for the E. J. Woodison Co., of Detroit.

J. HARRY MAIN, formerly supervisor of purchases for the General Motors Corporation, has been appointed Detroit district representative of the General Drop Forge Co., of Buffalo, with offices at Detroit.

P. A. MCARTHUR, formerly manager of the construction equipment department of W. A. Neal & Son, Inc., Atlanta, Ga., has joined the staff of the G. C. Phillips Tractor Co., of Birmingham, Ala., tractor and road building machinery distributors in the Alabama territory.

Obituaries

AUGUST SLUSSER, works manager of the foundry of the Westinghouse Electric and Manufacturing Co., at Trafford City, Pa., died on Aug. 3.

EDWARD F. ROSS, formerly associated with the Greenfield Tap and Die Corporation, as a salesman, died on July 21. He was 69 years old.

ROBERT M. BURTON, president of the American Laundry Machinery Co., died Aug. 10 at his summer home in Wianno, Mass. Mr. Burton was a native of Cincinnati, Ohio, and was 61 years old. He had been connected with the laundry machinery business for 31 years.

Business Items

The Landis Machine Co., of Waynesboro, Pa., announces the appointment of the following companies as sales representatives: The Chadwick Co., of Chicago, for the States of Illinois, Wisconsin, Iowa and northern Indiana; A. J. Vaughn, machinery expedition and sales department, the Bourse, Philadelphia, for eastern Pennsylvania, New Jersey and Delaware; William H. Harvey, 225 Denison Bldg., Syracuse, N.Y., for Syracuse, Rochester and central New York.

Durwyllan & Co., of Paterson, N. J., manufacturers of transmission linings, announce the opening of a new Southern office and branch distributing point in the Wynne-Claughton Bldg., Atlanta, Ga. G. W. Keeton has been appointed manager of the district.

The Union Manufacturing Co., of New Britain, Conn., announces that it has appointed the Machinists Supply Co., of Pittsburgh, as sole distributor for its products in that territory.

The Delco Light Co., of Dayton, Ohio, will take over the plant of the General Motors Co., near Dayton, and will remodel the layout and equipment for the manufacture of small refrigerating machines.

The Ford Chain Block Co., of Philadelphia, has acquired the patents, designs and equipment of the Motorbloc Corporation, also of Philadelphia. The manufacture of electrically operated chain hoists will be carried on by the new owner.

Trade Catalogs

Milling Machines. The Ingersoll Milling Machine Co., Rockford, Ill. A pamphlet has been issued to describe the Ingersoll circular, continuous milling machines. Several photographs show adaptions of the standard machine.

Condensors and Compressors. Pennsylvania Pump & Compressor Co., Easton, Pa. Bulletin Nos. 122, 123 and 124 have been published to cover the Pennsylvania aftercoolers, air compressors and vacuum pumps and Pennsy-portable air compressor.

Each bulletin is designed to fit the standard looseleaf album for ready reference. Complete data are given as to the sizes, capacities and weights of the equipment. Bulletin No. 124 tabulates the air pressure recommended to operate various compressed-air tools. Many sectional views and photographs are shown in illustration of the types of machines manufactured. Bulletin No. 122, on aftercoolers, contains considerable information on the operation and problems of this apparatus.

Electric Hoists. The Roeper Crane & Hoist Works, Inc., 1720-1738 North Tenth St., Reading, Pa., have prepared Form No. 118 to describe the type "R" hoist and to list general data on this model.

Electric Grinders. Wisconsin Electric Co., Racine, Wis. "Hitting the High Spots 50,000 Times Per Minute," is a small booklet describing the several models of Dumore grinders. Photographs show examples of practical applications of these grinders for unusual jobs and those which are too small for the ordinary grinder.

Electric Motors. Century Electric Co., St. Louis, Mo. Bulletin No. 38 is devoted to the type "SC" squirrel-cage induction polyphase motors which are made in sizes of from ½ to 7½ horsepower. Complete details are given and each part fully discussed.

Electric Controllers. Monitor Controller Co., Baltimore, Md. A circular entitled "Speed with Safety" describes the Monitor equipment in a Brooklyn shoe-last factory.

Metal-Splitting Saws. National Twist Drill & Tool Co., Detroit, Mich. The formed-tooth slitting saw, and the connecting-rod type slitting saw are described in a circular that gives the profiles and sections of these two models. The purposes for which they have been developed are also made clear in the description.

Lathe and Drill Chucks. The Westcott Chuck Co., Oneida, N. Y., have issued catalog No. 520, superceding all those of lower numbers, to illustrate and describe the models and styles of chucks, manufactured by this company. The prices of each size of the different models is also quoted.

Pipe-Threading Machinery. Landis Machine Co., Inc., Waynesboro, Pa. Catalog No. 29, 54 pages in length, has been published to illustrate and describe in detail the Landis stationary pipe dieheads, pipe-threading and cutting machines, pipe and nipple-threading dieheads, pipe and nipple-threading machines, and the Landis chaser grinder. The discussions and specifications of each machine are quite full, and at the end of the book is given a table of the Briggs and Whitworth standard pipe threads and a table of cutting speeds for pipe expressed in revolutions of the head or pipe per minute for various sizes of pipe.

Belt Lacers. The Clipper Belt Lacer Co., 974-1042 Front Ave., N. W., Grand Rapids, Mich., have issued catalog No. 22 to list the complete line of Clipper products. Specifications and details are given of the types of lacers, and a description of the process explains the use of the equipment which includes the carded belt hooks, belt lacers, belt cutters, special pins and twisted-rawhide pins. A treatment of the relative strength and effective tension in belting and lacing is given at the end of this 30-page book.

Ball and Roller Bearings. Norma-Hoffmann Bearing Corporation, Stamford, Conn. Bulletins 904 and 905. Two 8½x11-in., twenty-page catalogs enter into considerable detail in discussing the "Hoffmann" heavy-duty roller and ball thrust bearings and the "Norma" open and closed types of ball bearings. Instructions are given for the mounting of the bearings and for their lubrication, and tables list the specifications of each type.

Blowers. American Blower Co., Detroit, Mich. Form No. 1902 describes the uses and applications of the Sirocco Ventilating fans, equipped with multiblade wheels for heavy-duty circulation.

Form Nos. 2713 and 2813, entitled "Banish Your Office Sandman," illustrate the uses of the Ventura disk fans designed for ventilation purposes.

Form No. 3518 details the advantages of and describes the Venturaf in method of heating.

Burner Products. The Chausse Oil Burner Co., 1227 West Beardsley Ave., Elkhart, Ind., has issued Circular No. 8 to catalog the Chausse oil-burning lead melters, babbit melters, and asphalt-smoothing irons. Illustrations of each model are included.

Lathes. Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. Circular No. 316 discusses the features of design of the "Time Saver" lathes built by this company. Illustrations and line drawings are used to show each part described. The "Time Saver" lathes are made in three sizes, the general dimensions of which are included in the catalog.

Turret Lathes. The Acme Machine Tool Co., Cincinnati, Ohio. Several 8½x11-in. bulletins and sheets have been published and assembled in a loose-leaf binder. This series of booklets contains the descriptions and details of the Cincinnati Acme No. 1 semi-universal flat turret lathe, Nos. 2 and 3 full-universal flat turret lathe, and the No. 4 universal hexagon turret lathe. The additional circulars cover individual sizes of screw machines, turret lathes and accessories including collets, chucks, tools, and tap and die sets. The features, specifications and equipment of each machine are gone into quite fully.

Lubricating Systems. The Madison-Kipp Corporation, Madison, Wis., is publishing a series of monthly circulars illustrating practical installations of the fresh-oil lubricating systems. The methods used in each case are described.

Planers. The Cleveland Planer Co., 3148 Superior Ave., N. E., Cleveland, Ohio, has issued a circular giving specifications and details of the Cleveland open-side planers.

Slitting Saws. Goddard & Goddard Co., Detroit, Mich. "Real production tools, No. 4," describes the theory and design of the "Go and Go" line of metal slitting saws that are intended for cutting cast iron, steel, copper and aluminum, there being different features in the design of each.

Taps and Thread Hobs. Pratt & Whitney Co., Hartford, Conn. Circular No. 318, with eight 9x11-in. pages, is a full treatment of the processes of manufacture of the Pratt & Whitney Co. ground-thread taps and thread hobs. Tables of specifications and tolerances are included.

Pamphlets Received

A. E. F. Welding Illustrated. Published by the American Electric Fusion Corporation, 2610-2620 Diversey Ave., Chicago, Ill. The July, 1925 number, now being circulated, is the first issue of a new monthly to cover welding problems and methods.

Review of Iron and Steel Literature for 1924. By E. H. McClelland, Technology librarian, Carnegie Library, Pittsburgh, Pa. Published by the Carnegie Library, Pittsburgh, Pa. This pamphlet constitutes an attempt to list the more important publications for 1924 on mining, metallurgy, testing, economics, foundry practice, refractories, corrosion, structural steel and the statistics and history of the industry.

International Association of Industrial Accident Boards and Commissions, Index to Proceedings, 1914-1924. By Glenn L. Tibbott. Published by the Department of Labor, Washington, D. C., Bulletin No. 395. This booklet contains a subject and a name index of papers, and their authors from the inception of the first meeting in 1914 of this organization.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

American Gear Manufacturers' Association. Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Improvement continues in pig-iron inquiries; prices are about the same as a week ago. Iron and steel scrap is advancing. There is fairly good buying but with no appreciable price changes in tin plates, pipe, sheets, hoops, bands and wire products. Steel bars, however, are slipping from position as firmest of the heavy rolled products; quotations now range from $1.90 to $2 per 100 lb., Pittsburgh mills, against a minimum of $2 formerly. Plates are $1.90 and shapes, $1.80@$2 per 100 lb. at mill.

Non-Ferrous Materials—Prices of machine shop materials and supplies are steadiest in the Cleveland market. There is considerable fluctuation in Chicago. In New York demand is fair for non-ferrous metals, with the possible exception of zinc. Antimony is firm with supply limited. There is better domestic buying of tin.

(All prices as of Aug. 14)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	18 50@19.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.26
Virginia No. 2	29.17
Basic	21.16
Grey Forge	
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.77
Basic	20.77
Bessemer	20.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00
Cleveland	4.90@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.10	3.50
No. 12	2.35@2.45	3.94	3.15	3.55
No. 14	2.40@2.50	3.99	3.20	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.00	4.15	3.70	3.80
Nos. 22 to 24	3.00@3.05	4.20	3.75	3.85
Nos. 25 and 26	3.05@3.10	4.25	3.80	3.90
No. 28	3.15@3.20	4.35	3.90	4.00
Galvanized				
Nos. 10 and 11	3.20@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.30@3.35	4.45	4.20	4.10
No. 16	3.45@3.50	4.60	4.35	
Nos. 17 to 21	3.60@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.90@3.95	5.05	4.80	4.70
No. 28	4.20@4.25	5.35	5.10	5.00

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50		4.00@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05		
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			59.12½
Lead (up to carlots) E. St. Louis	8.90	New York	9.87½
Zinc (up to carlots) E. St. Louis	7.52½	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00		
Copper sheets, base	22.75	22.50	22.75
Copper wire, base	20.25	16.75	16.75@17.00
Copper bars, base	21.87½	21.00	21.87½
Copper tubing, base	24.75	25.00	24.75
Brass sheets, base	19.12½	18.75	19.12½
Brass tubing, base	23.75	23.50	23.75
Brass rods, base	16.87½	16.37½	16.87½
Brass wire, base	19.62½	21.12½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	11.50	10.75
Solder (½ and ½), (case lots)	39.50	38.00	38@42
Babbitt metal (83% tin)	60.00	69.25	58@63
Babbitt metal (35% tin)	28.00	20.50	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@13.75	12.00	12.50@13.00
Copper, heavy, and wire	11.75@12.25	11.75	11.75@12.25
Copper, light, and bottoms	10.00@10.25	9.75	10.75@11.25
Heavy lead	7.37½@7.62½	6.75	8.50@ 9.00
Tea lead	6.00@ 6.25	4.25	7.00@ 7.50
Brass, heavy, yellow	7.25@ 7.75	7.25	8.00@ 8.50
Vrass, heavy, red	8.00@ 8.25	9.50	9.75@10.25
Brass, light	6.00@ 6.50	6.00	7.50@ 8.00
No. 1 yellow rod turnings	8.00@ 8.25	7.75	8.00@ 8.50
Zinc	4.50@ 5.00	4.00	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.18
Cotton waste, colored, per lb.	.10@ .15½	.18	.17
Wiping cloths, 13½x13½, per lb	.17	36.00 per M	.11*
Wiping cloths, 13½x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.75
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.08	1.14	1.00@1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.72
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	30–10%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	50%
Second grade	50–10–5%	60–5%	50–10%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold finished shafting	per lb.	.0415	.0415	.0415
Brass rods	per lb	.1637½	.1587½	.1475
Solder (½ and ½)	per lb.	.395	.395	.375
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.40
Cloth	3.55	2.67	3.55
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.90@3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x⅜in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for ⅛-in. and smaller and 65% for ¼-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x 2⅛-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, ⅛x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Chicago—Illinois Central Railroad, 135 East 11th Place, J. J. Bennett, Purch. Agt.—hand power punch and shear, 30 in. engine lathe, 32 in. heavy duty crank shaper, combination double head grinder for plant at Sioux City, Ia.

Mass., Boston—D. Breckman, 43 Tremont St.—tools and equipment for repair and service garage on Warren St., Roxbury.

Mass., Boston—Moynahan & Erlandson, 59 Carver St.—miscellaneous repair tools and equipment for extensive garage on Albany St.

Mass., Boston—Schoolhouse Dept., City Hall—manual training equipment including metal working machinery for South Boston high school.

Mass., East Boston (Boston P. O.)—P. Autonucci, 210 Marion St.—miscellaneous tools and equipment for repair garage.

Mass., East Boston (Boston P. O.)—J. A. Kraft, 9 Border St.—3 x 36 sheet metal roller.

Mass., East Douglas—Supt of Schools—manual training equipment for new high school.

Mass., Lowell—Nebes Co., 280 Lawrence St.—combination band saw, saw table and planer, power hammer, jig saw, surface grinder and chuck, double saw table.

Mass., South Boston (Boston P. O.)—T. J. Fowler, 553 East 6th St.—repair tools and equipment for service garage.

Mich., Detroit—James Motor Valve Co., 1344 Maple St. (manufacturers automobile parts)—general machine equipment.

Mo., Kansas City—The Birmingham Sash & Door Co., 1000 North 16th St.—equipment for new plant.

Mo., St. Louis—Ponath Bank Mfg. Co., Inc., 5178 Easton Ave., E. F. Ponath, Purch. Agt. (electric appliances.)—lathes, drill presses, etc.

Wis., Stoughton—Roe & Jacobs Sash and Door Co.—woodworking machinery.

Ont., Guelph—New System Heating Co.—equipment for $50,000 plant for manufacture of oil burners, ventilators and dust collectors.

Ont., Hawkesbury—O. Menard, Vanhleek Rd.—mortiser, tenoner, etc.

Ont., Listowel—R. McMillan (garage and auto repairs)—complete equipment to replace fire loss.

Que., Bourget — O. Belanger — reboring machine and lathe.

Que., Brunet—E. Viger—general sawmill equipment.

Que., Calumet — Weldon Bros. — lathe, grinder and press.

Que., Hudson—L. Dufresne—miscellaneous tools and equipment for repair and service garage.

Que., Lac Frontiere—C. Chasse (sawmill)—drum saw, band saw and other machinery.

Que., Lachute—E. Charlebois (furniture)—planer and cut off saws.

Que., Montreal—National Refrigerating Machines, Ltd., 39 Vitre St., W.—machinery and equipment for new plant at Arnprior, Ont.

Que., St. Eugene—Oscar Suprenant—miscellaneous tools and equipment for garage and repair shop.

Que., St. Marcel—A. Fortin (sawmill)—swing cut off saw, rip saws, etc.

Que Ste. Agathe des Monts—J. Lamoureut, Principal Ave.—small lathe, drill press, grinder, etc.

Australia, Melbourne—Victorian Government Railways, will receive bids until September 23d for a vertical spindle grinding machine complete with equipment. Will also receive bids until September 30th for elliptical spring plate forming machine with accessories.

Opportunities for Future Business

Ala., Acipco—American Cast Iron Pipe Co., Birmingham, having plans prepared for the construction of addition to plant for the manufacture of pipe here, 500 tons daily capacity. Estimated cost $400,000.

Calif., Oakland—National Lead Co., 47th Ave. and East 10th St., awarded contract for the construction of a 3 story plant. $24,000.

Calif., Marysville—B. N. Nelson, Oroville, is having plans prepared for the construction of the first unit of box and moulding plant on 8th and Yuba Sts. Estimated cost $25,000.

Calif., San Francisco—Pacific Foundry Co., 18th and Harrison Sts., awarded contract for the construction of a 2 story pattern shop on Treat Ave.

Conn., Groton (New London P. O.)—E. W. Jones, 28 Thames St., will receive bids until August 22d for the construction of a 2 story, 50 x 100 ft. sales and service garage on Thames St. Estimated cost $50,000. Bilderbeck & Langdon, Inc., State St., New London, Archts. and Engrs.

Conn., Hartford—Connecticut Co., 127 State St., awarded contract for the construction of a 1 story, 100 x 240 ft. repair shop and bus station on Vine St. Noted July 23.

Your machine-tool wants inserted here free of charge

Address
BUSINESS NEWS DEPARTMENT
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Conn., New Britain—Fafnir Bearing Co., Booth St., plans the construction of addition to plant for the manufacture of ball bearings on Orange St. Estimated cost $200,000. Architect not selected.

Conn., New Haven—Sargent & Co., Water St., awarded contract for the construction of a 1 story, 60 x 210 ft. factory for manufacture of hardware at Water & Wallace Sts. Estimated cost $75,000. Noted July 2.

Conn., Waterbury—Patent Button Co., 41 Browney St., awarded contract for the construction of a 4 story, 60 x 176 ft. plant on Abbott St. Estimated cost $200,000. Noted July 23.

Ill., East St. Louis—Sandusky Cooperage & Lumber Co., Buder Bldg., St. Louis, Mo., will build a 1 story, 58 x 300, 48 x 160 and 48 x 100 ft. cooperage plant on Trendley Ave., here.

Ind., Columbus—Indianapolis Pump & Tube Co., Q. Noblitt, Pres., has work under way on the construction of first unit of plant. Second unit will be started soon.

Kan., Kansas City—H. N. Strait Mfg. Co., Adams & Shawnee Sts., plans the reconstruction of a 75 x 215 ft. foundry destroyed by fire. Estimated cost $50,000. Architect and engineer not selected.

Mass., Atlantic (Boston P. O.)—Norfolk Woodworking Co., Braintree, is having plans prepared for the construction of a 1 story, 140 x 260 ft. main mill building on Hancock St., here. L. S. Joslin, 339 Newbury St., Boston, Archt.

Mass., Boston—I. S. Stone, 53 State St., will build a 1 story repair and service garage on Magoun Sq. Estimated cost $40,000. Noted Aug. 6.

Mass., Charlestown (Boston P. O.)—S. M. Howes Co., 509 Medford St., awarded contract for the construction of a 3 and 4 story factory and heating plant on Medford St. Estimated cost $100,000.

Mass., Dorchester (Boston P. O.)—Dept. of Public Works, J. A. Rouke, Comr., Boston, plans the construction of a 1 story repair and service garage on Hancock St., here. Estimated cost $50,000. Mulhall & Holmes, 33 Newbury St., Boston, Archts.

Mass., Lynn—E. N. Foss, 120 Franklin St., Boston, is having preliminary plans prepared for the construction of a 1 story garage at 917 Washington St., here. Estimated cost $160,000. E. B. Stratton, 25 Arch St., Boston, Archt.

Mass., Lynn—General Electric Co., Western Ave., will build a 1 story, 55 x 100 ft. forge shop. Private plans. Noted July 23.

Mass., Worcester—G. P. Fountaine, c/o H. L. Meacham, 57 Main St., Archt., is having plans prepared for the construction of a 2 story, 40 x 60 ft. addition to repair and service garage at 141 Washington St. Estimated cost $40,000.

Mich., Detroit—Godfredson Body Corporation, Wayne, plans the construction of a 3 story, 60 x 540 ft. addition to auto body plant on Michigan Ave., here. Esselstyn & Carey, 602 Hoffman Bldg., archts.

O., Cleveland—Fisher Body Ohio Co., A. Byers, East 140th St. and Cort Road, awarded contract for the construction of a 5 story, 72 x 504 ft. addition to plant. Estimated cost $300,000.

Pa., Oil City—Kramer Wagon Co., will build a 1 story addition to plant on Mineral St. Estimated cost $40,000. G. F. Dennett, c/o owners, Engr.

R. I., Providence—Providence Gas Co., Turks Head Bldg., awarded contract for the construction of a 1 story, 85 x 290 ft. garage, 3 story, 85 x 220 ft. service building, 50 x 80 ft. boiler house, and a 2 story, 45 x 85 ft. stable at Potter Ave. and Dexter St. Estimated cost $300,000. Noted July 30.

Tenn., Iselin—Mobile & Ohio Railroad Co. has work under way on the construction of the second unit of plant here, including heavy machine, light machine, boiler, blacksmith, flue, tank and wheel shops. Estimated cost $1,000,000. B. A. Wood, Attorney Security Bldg., St. Louis, Mo., Ch. Engr.

Va., Hampton—R. E. Wilson, Phoebus, plans the construction of a barrel factory, here.

Wis., Madison—The Buick Garage Co., Z. S. Baldwin, Pres., North Washington Ave., awarded contract for the construction of a 3 story, 60 x 150 ft. garage and repair shop on Wilson St. Estimated cost $150,000.

Wis., Milwaukee—David & Tuckwell, 37 National Ave., Engrs., is receiving bids for the construction of a 1 and 2 story, 62 x 120 and 30 x 40 ft. plant for the manufacture of laundry specialties on Center St. for Huebsch Mfg. Co., 368 Brady St. Estimated cost $40,000.

Wis., Shawano—Shawano Lumber Co. will build a 2 story, 40 x 120 ft., saw mill to replace fire loss. Estimated cost $75,000. Private plans.

B.C., Vancouver—Vancouver Motors, Ltd., 254 Kingsway St., awarded contract for the construction of a 3 story, 120 x 125 ft. plant at Smythe and Seymour St. Estimated cost $150,000.

Que., Chat Falls—James Robertson Co., 142 William St., Montreal, will soon receive bids for the construction of a lead and zinc manufacturing plant on the Ottawa River here. Estimated cost $2,000,000.